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JULY 1956

APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER
including Air Controls, Air Circuit Design and Electrical Controls...

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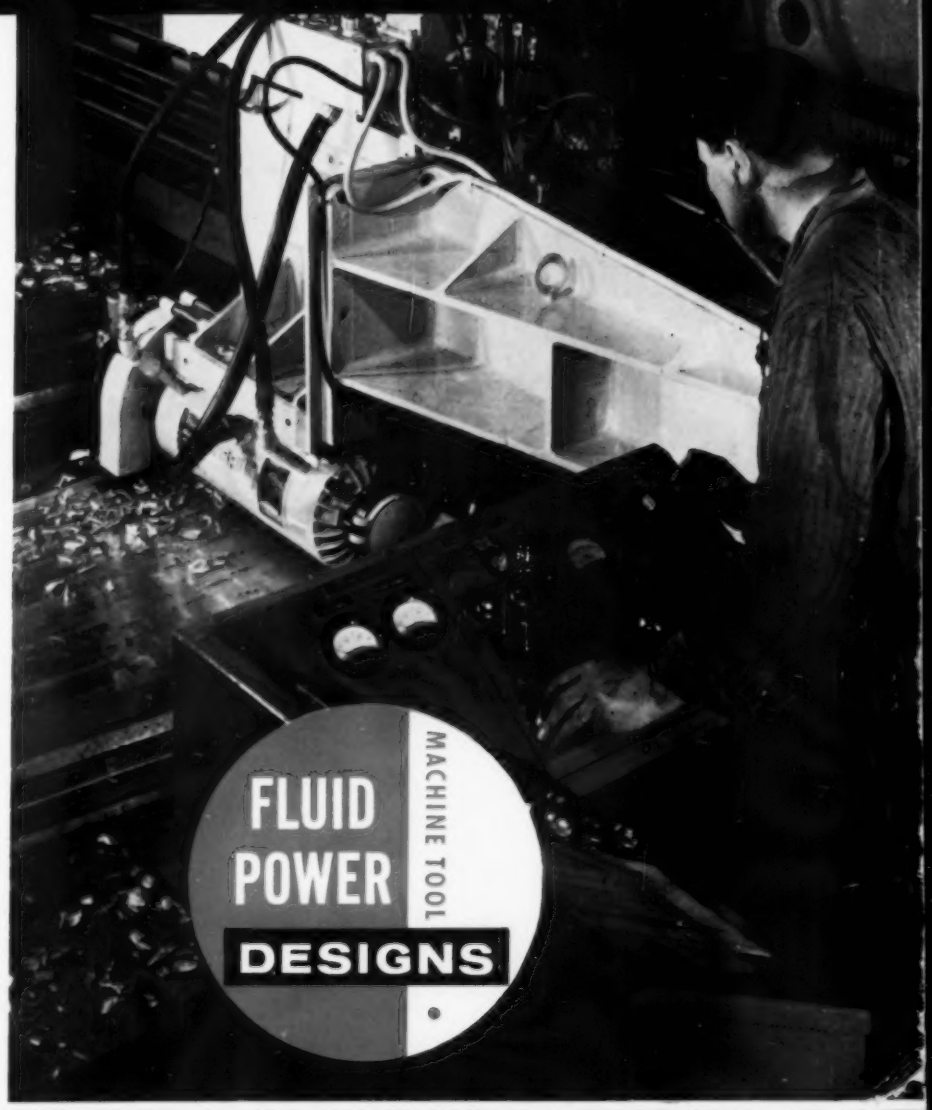
FRANCHISE CIRCULATION



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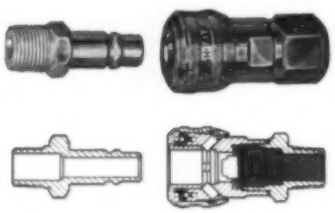
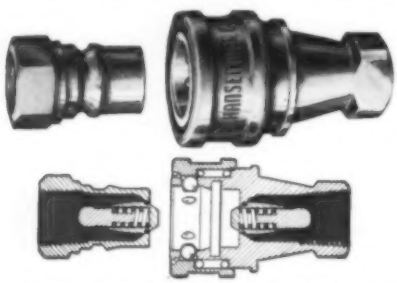


ONE-WAY SHUT-OFF
Shuts off one side of line

Gives quick connection and disconnection, with instant automatic flow or shut-off. To connect Coupling and open line to flow of fluid, merely push Plug into Socket. To disconnect, a slight pull on sleeve releases Plug and shuts off supply end of line.



TWO-WAY SHUT-OFF
Shuts off both sides of line

To connect, pull back sleeve and push Plug into Socket. Identical torpedo type valves permit free flow of gas or liquid through Coupling. To disconnect, pull back sleeve . . . Coupling immediately disconnects, valves automatically seal both ends of line. Female pipe thread connections from ⅛" to 1". Available in brass or steel.

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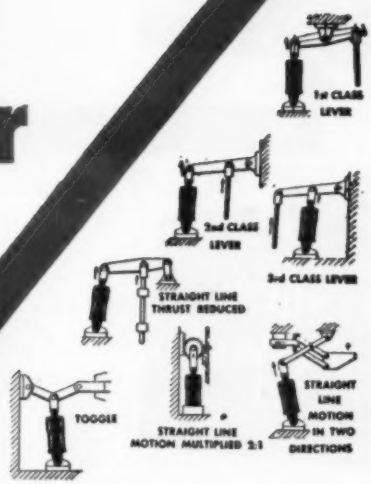

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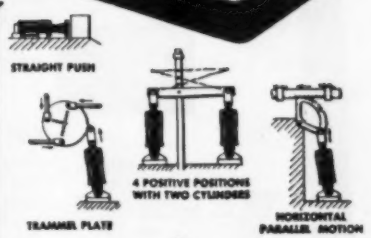

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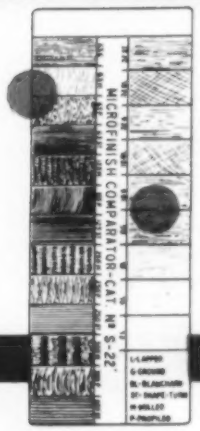

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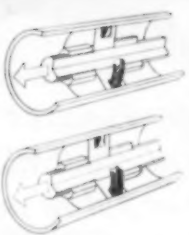

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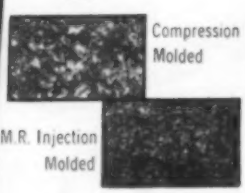

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JULY 1956
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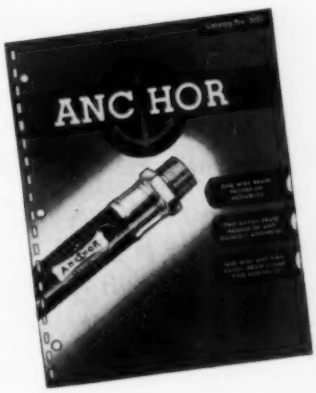
NEW AND IMPORTANT DATA ON ANCHOR LPG HOSE ASSEMBLIES AND COUPLINGS



Complete engineering data on Anchor Hose Assemblies and Couplings designed especially for use with Liquefied Petroleum Gas including cross-sectional views and assembly instructions, is now available in the New Anchor Catalog No. 500 just off the press.

Anchor Pressed-On LPG Hose Assemblies are now available in several different hose styles, including a one-wire braid hose and a two-rayon braid hose for medium-low pressures to 350 PSI, both with tough Neoprene covers, and a two-rayon braid hose for low pressure installations to 250 PSI with a porous abrasive resistant rubber compound cover. The Neoprene covers on the first two styles are perforated to prevent blistering and all covers protect the hose against the deteriorating effects of Propane, Butane, lubricating oil, weather and abrasion.

Anchor precision made and applied couplings are pressed-on securely to prevent leaks.

Also available are three types of reusable couplings for use on LPG Hose—the new, improved "Duloc" Coupling (for style LW one-wire braid Hose), a streamlined, easily assembled coupling exclusive with Anchor —the standard Anchor reusable coupling (for two-rayon braid hose),—and the rugged and dependable Anchor Clamp-Type Couplings (for both wire and rayon braid type of hose). All of these hoses are designed for immediate on-the-job repair. Write for this informative catalog No. 500. Anchor Coupling Co. Inc. 366 No. Fourth Street, Libertyville, Illinois.

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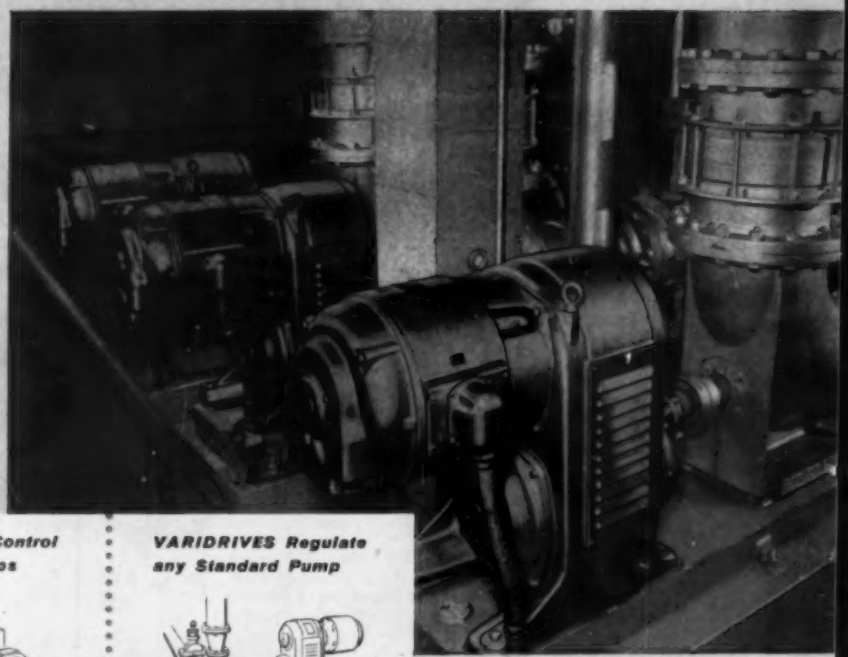
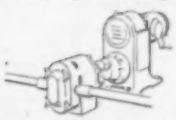
Control Pumping with U. S. VARIDRIVES

Regulating the High and Low of Sewage Flow with U.S. VARIDRIVES

Thirty-two 20 h.p. U. S. Varidrive motors like these shown increase or decrease necessary pumping action of axial flow pumps which transfer sewage at the new Hyperion Sewage Disposal Plant of the City of Los Angeles. This is another example of the versatility of U.S. Varidrive motors to handle variable speed pumping problems in all types of industry. Varidrives are available from ¼ to 60 h.p. Speeds 2 to 10,000 rpm.

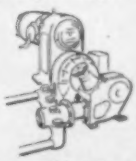


VARIDRIVES Power Pumps used for Pumping Beverages



High pressure, low volume rotary positive displacement pumps used in food plants have a variety of uses with the help of variable speed.

VARIDRIVES Control Metering Pumps



Piston type, positive displacement pumps used for proportioning or metering liquids are often regulated by Varidrives.

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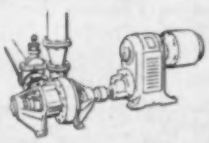

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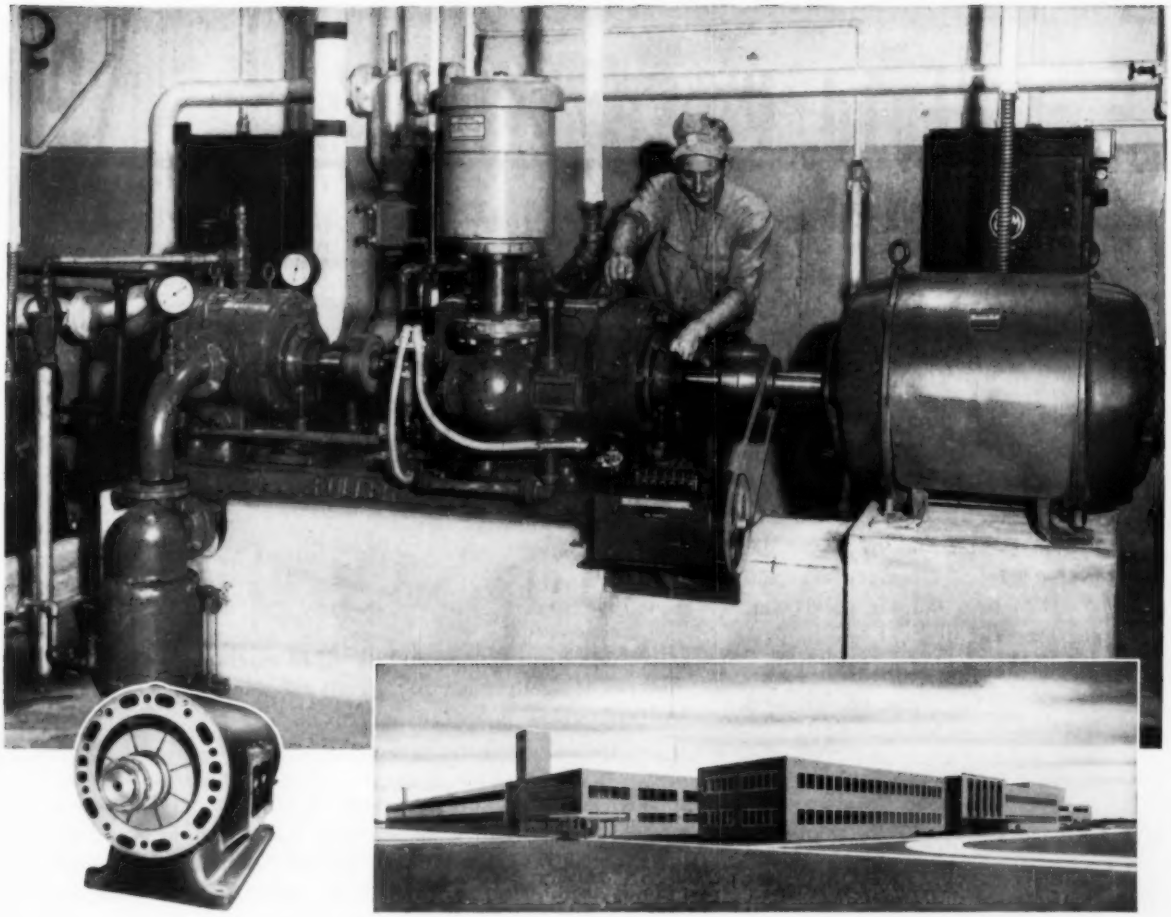

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When Electric Controller & Manufacturing Company, Division of Square D Company, Cleveland, Ohio, designed and built its new four and one half million dollar plant, they had their sights set on economical production at high-level efficiency.

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For a full description of Fuller Rotary Compressors and Vacuum Pumps, we would like to send you a copy of Bulletin C-5A. Write for your copy today.

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Fluid Power Lines

about Applied Hydraulics

LONG TERM DEMAND . . . Louis Polk, who heads the Sheffield Corporation and the National Machine Tool Builders Association, has predicted that by 1980 the nation's labor force could be too small to turn out the goods and services required if mechanization isn't speeded up. He arrives at this conclusion by plotting trends in total production and labor force during the past 25 years and projecting these trends 25 years into the future.

This conclusion poses a real challenge to everyone in industry and government. To the design engineer it holds open the door for accelerated improvement of production methods and equipment. Where does fluid power fit into this growth pattern? The articles in this issue are aimed to show how designers are presently using air and hydraulic circuits to improve machining operations. Machines having higher speeds, greater power, precision feeds and automatic control will be making wider use of fluid power in 1980. This increased use will be the result of better components, greater knowledge of circuit design and increased know-how in the care of fluid power equipment.

MACHINE TOOL FORUM . . . Turn to page 65. Here's your opportunity to sit down with more the 150 users and designers of machine tools to learn about their ideas and experience with hydraulics. The forum, sponsored by Vickers Inc., was held late in May. Our report gives you up-to-date information on circuits, fittings and tubing, fluids, cylinders, pumps, valves, motors, filters, seals, coolers and maintenance.

FINE FEEDS . . . When you talk about machine tool design, methods for getting accurate feeds are a top subject. While hydraulics has many advantages as a power source for feeds, there is still much to be desired in the way of precise control for widely varying loads, temperatures and speeds. Karl Schubert's article describes a feed pump which, to our knowledge, has not been used in America or described in a design article. This German design permits accurate control over a wide range of flows down to about 1 to 1.5 cubic inches per minute.

THOSE EXTRA OPERATIONS . . . Very often, what started out to be simply—"poke some holes in these pieces for assembly"—turns into a time consuming job. To get the holes drilled, there's some layout to be done, then center punching and spot drilling before the final drill. After drilling, reaming might be necessary along with countersinking or counterboring. Two articles in this issue tell about machine designs which attack the "hole-making" problem. A. D. Roubloff tells how hydraulic control results in accurate countersinking. Hydraulic indexing which eliminates the need for part layout and center punching is described in the second article.

CONTOUR MILLING . . . W. C. Kraft's article shows how a standard hydraulic tracer system has been applied to a giant milling machine. This tracer system has been in use for a number of years on lathes, mills, planers and shapers. While there will be many tracers in use in 1980, we can't help but wonder if in the future, giant hydraulic forging presses might not make this particular machining job unnecessary.

FLUID POWER MACHINE DESIGNS TOOLS

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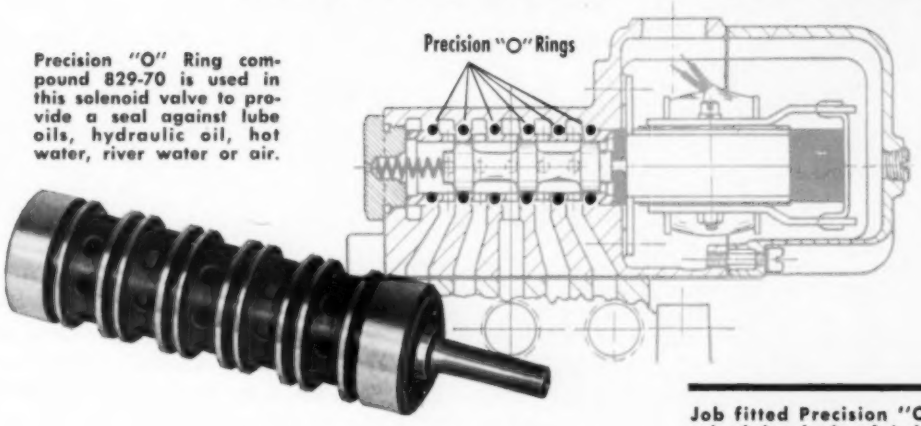
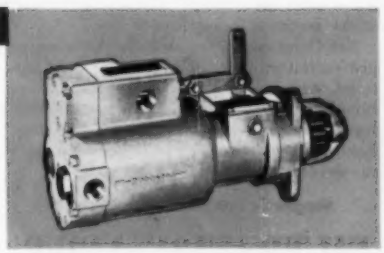
Versatile PRECISION "O" RING fills sealing requirement in dozens of industrial products

Precision "O" Ring compound 829-70 is used in this solenoid valve to provide a seal against lube oils, hydraulic oil, hot water, river water or air.



Job fitted Precision "O" Rings have solved hundreds of industrial, aircraft and automotive sealing problems.

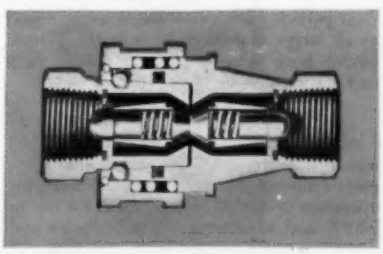


Precision "O" Rings were selected for this cranking motor after exhaustive tests for flexibility and sealing in arctic cold.

Uniformity of size, excellent surface quality, compatability with a wide range of fluids . . . Numatics, Inc. of Milford, Michigan, cite these as reasons why "O" rings made from Precision Compound 829-70 are being used in their solenoid valves. They are giving service through more than 30,000,000 valving actions.

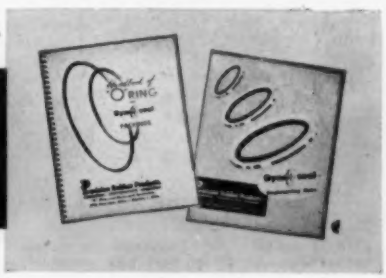
Hundreds of Precision "O" Ring compounds are meeting the exacting requirements of industry. Modern pre-testing methods and engineering skill assure dependable, long life service. They are compression molded — rigidly inspected — meet all military and commercial specifications — the finest made! At Precision, you'll find "O" rings in sizes and compounds to meet your requirements.

What is your sealing problem? There is an expert — the Precision engineer — ready to help you in product design and "O" ring specifications. You can rely on him — and on Precision, the world's largest exclusive producer of "O" Rings.



In this coupling, an "O" ring made from Precision Compound 829-70 seals against hydraulic fluids and pneumatics.

Write for your free copies of Precision catalogs on "O" Rings and Dyna-seals



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Dept. 1, Oakridge Drive, Dayton 7, Ohio

Canadian Plant at: Ste. Thérèse de Blainville, Québec

MAGNETIC PORO-KLEAN FILTER element. In use, submicronic ferromagnetic particles stick like clips in photo.

Magnetic filter protects servo valves

A sticky servo valve in the hydraulic control system for a Mach one-plus airframe is sticky business indeed!

Yet Cuno engineers recently encountered just such a problem. Submicronic wear particles, well below the size range of conventional filters at the temperatures and pressures involved, contaminated the hydraulic fluid. These tiny particles, in the servo valve caused erratic operation, and instability.

Magnetic PORO-KLEAN is answer

FILTRATION NEWS

Cuno's new magnetized porous iron filter solves this problem by removing ferritic wear particles 2 microns and smaller as well as all larger non-magnetic particles. Three models have been designed to handle ½, 3 and 8 gpm of MIL-0-5606 hydraulic oil.

Filters to AN specs or better

Standard PORO-KLEAN filters of porous 316 stainless steel are also available in a complete range of standard AN 6235 sizes for operation to 350°F. Similar filters for use to 900°F. and a variety of cup, cylinder and disc shapes are also available.

Ask your local Cuno representative for all the facts on versatile, high-strength, high-temperature, corrosion-resistant PORO-KLEAN for aircraft or industrial filters. Or write Cuno Engineering Corporation, 2-7 South Vine Street, Meriden, Conn. 5.21

FREE! Send for new PORO-KLEAN Catalog No. 058!

CUNO ENGINEERED FILTRATION

AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous stainless steel)

Fluid Power Lines

continued

WHO'S ON FIRST? . . . You can't tell who's on first base without a program—and it's doggone tough to tell how the oil is controlled without a circuit drawn to JIC standards. Machine tool users of hydraulics have to learn how to read JIC drawings because most builders are using the standards. Peter Coffaro, of Avey Drilling Machine, writes a short article, starting on page 86, which will help the fellow who has not caught up with JIC drawings.

FASTER LOADING . . . That fellow J. R. Williams who draws the cartoon "The Bull of the Woods" often shows a giant lathe or planer on which setup took hours and then the machinist is shown dreaming while the cut takes all day. In these days when much publicity is given to increased mechanization, we sometimes forget that some of those "gravy" jobs still have to be machined. A designer who can whack off an hour from a 10 hour job may have a tougher time than the fellow who cuts 6 seconds off an operation taking a minute. New cutting tools are reducing machining time on these big jobs and new loading equipment is speeding setup time. John Fawcett's article describes an oil powered loader which has increased production on a planer by 75 to 90 percent.

REVERSING PUMPS . . . Using a variable volume pump on which the pumping can be shifted to alternate suction and discharge ports offers a number of advantages to machine tool designers. On page 77, we've outlined the design of a two station grinder which uses two variable delivery pumps of the radial piston type. This machine has an automatic cycle which provides an output of 250 pieces per hour with .063 inch stock removal.

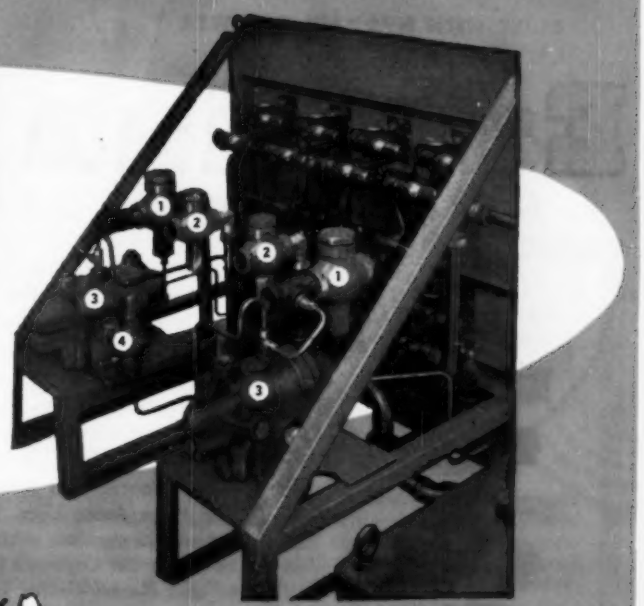
PLANT TOUR . . . Several months ago, Marshall Swisher, who is the hydraulic engineer at Packard-Clipper Division's new Utica engine plant, took us on a tour. Marshall has done a wonderful job of organizing and carrying out a training course for hydraulic maintenance of machine tools. Last month, in the Briefs columns, this training program was described. This month, we've included an article which details four simple hydraulic circuits which have been added to machines in the Utica plant.

A Compact Hydraulic POWER HOUSE
one of many built by Racine for you . . .

ALL COMPONENT PARTS ARE
RACINE DESIGNED AND BUILT
"They work better together"

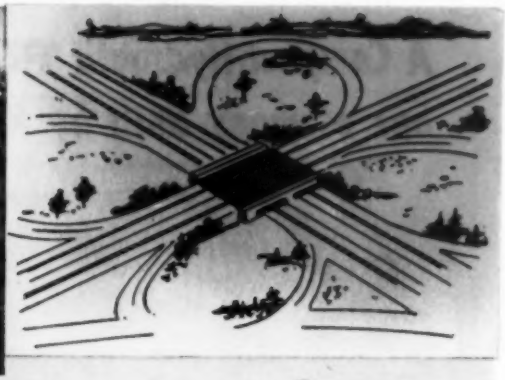
RACINE
Variable Volume
OIL HYDRAULIC PUMPS

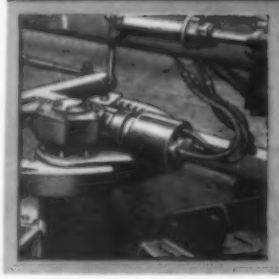
1. RACINE Pilot Operated Check Valves
2. RACINE Free Flow and Throttling Check Valves
3. RACINE Pressure Boosters
4. RACINE Sequence Valve
5. RACINE Variable Volume Pump
6. RACINE Oil Reservoir
7. RACINE Solenoid Controlled, Pilot Operated 4-way Valve
8. RACINE Solenoid Operated 2-way Valve



SALES AND SERVICE REPRESENTATIVES
IN ALL PRINCIPAL CITIES.

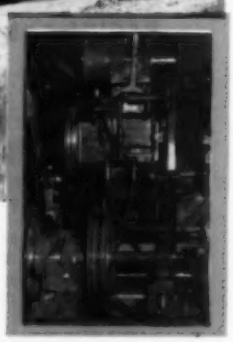
Racine Hydraulic Components Simplify any Hydraulic Circuit — "They Work Better Together." Write for complete Racine Hydraulic Catalog and the name of your nearest Racine Field Office. Complete Engineering Service Available. Address: **RACINE HYDRAULICS & MACHINERY, INC.**, 2074 Albert St., Racine, Wisconsin, U.S.A.





GALION 104 Motor Grader, above, uses Eastman Assemblies on *EIGHT* Hydraulic controls for more accurate, effortless and economical grading. Close-up, left, shows powerful Hydraulic Circle Turn for famous Galion "Reversible" Moldboard.

BARBER-GREENE Bituminous Finisher, right, automatically lays level finish for smoother, safer travel. Close-up shows Eastman Hydraulic Hose Assembly delivering 2,700 lbs. pressure to raise and lower finishing screed.



Smoother, Safer Roads

BUILT WITH HYDRAULIC POWER

DELIVERED THROUGH

Eastman

HYDRAULIC HOSE ASSEMBLIES

ALWAYS SPECIFY

EASTMAN Pressed-on, Reusable and Renewable Couplings for high and low pressure air, gas, water, paint, grease and hydraulic fluids. Eastman Straight and Angled Adapter Unions.

Smoother, safer highways are being built today through the application of modern engineering and the use of modern equipment—much of which is hydraulically operated—using Eastman Hydraulic Hose Assemblies.

GALION—pioneer builder of road machinery—whose Motor Graders and Rollers are used 'round the world—first used hydraulic controls as early as 1927. Eastman Mfg. Co. pioneered in the development of Hydraulic Hose Assemblies in 1926—and *Galion is Eastman equipped today!*

BARBER-GREENE—whose Bituminous Road Finishers have been used at one time or another on almost every road ever built—also uses Eastman Hydraulic Hose Assemblies. Hydraulic power is used to raise and lower the all-important mechanism which lays a level finish—regardless of irregularities in the base. Barber-Greene's founding date of 1916 closely parallels Eastman's of 1914—and *Barber-Greene is Eastman equipped today!*

EASTMAN—*first in the field*—is proud to have pioneers such as Galion and Barber-Greene—as well as many other leading American manufacturers—use Eastman Hydraulic Hose Assemblies. Look to Eastman for *continued leadership* in engineering and design for quality of material and workmanship—plus better-than-ever service through expanded production facilities of our new, modern plant.

SAFEGUARDING INDUSTRY'S Lifeline of Mobile Power

Eastman
first in the field
MANUFACTURING COMPANY
Dept. AH-7, Manitowoc, Wis.

WRITE for Eastman Catalog or send blueprints stating your hydraulic requirements and specifications.

LETTERS to the editor

Accurate Synchronization

We urgently need a valve that will divide the flow of oil equally to two cylinders of the same diameter moving almost equal loads.

We have heard a great deal of talk about flow equalizer valves; however, the only one we have come across can't be delivered for six months.

The motion synchronizing circuits shown in your publication "Fluid Power Circuits" (published January 1954) are not considered to be accurate enough for the particular application we have in mind.

F. W. CAYLEY
TEM Sales Company Ltd.
Toronto, Canada

We have sent you the name of a source for a flow equalizing valve which we hope can be delivered in less than six months.

Because of unequal slippage which is bound to occur between the two cylinders, perfect synchronism is too much to expect. Therefore, it is good practice to include some means of assuring that the two cylinders start out at the same point at the beginning of each stroke so that any difference is not accumulated.

A good arrangement is a series circuit with suitable flow controls and a replenishing setup to bring the cylinders into synchronism at the beginning of each stroke.

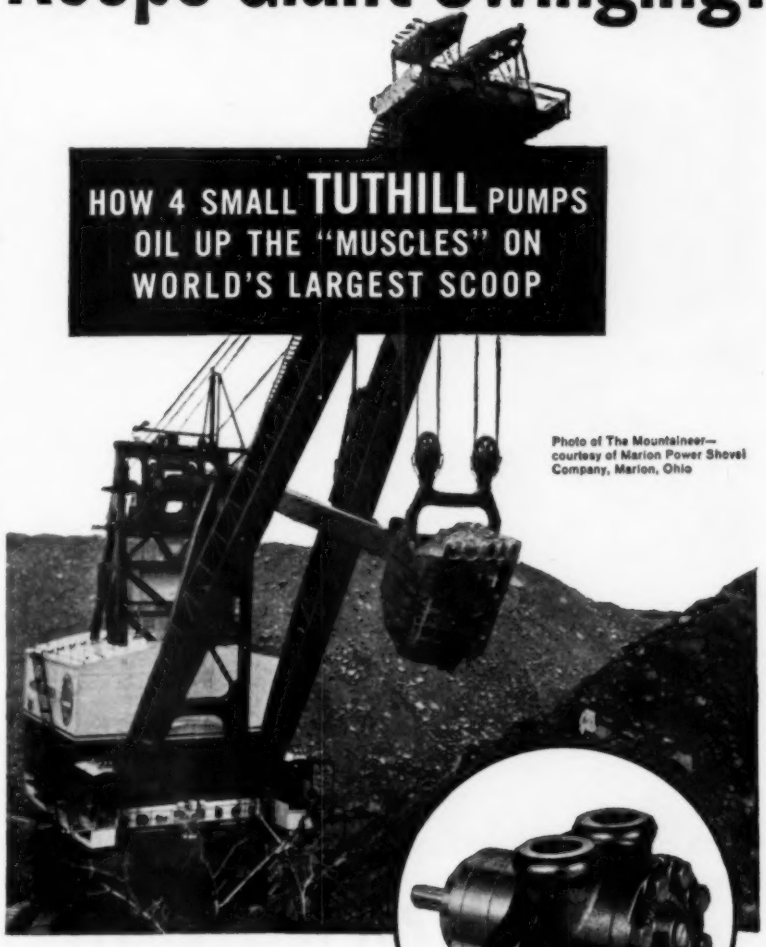
We will welcome comments from readers having experience with synchronizing cylinder motion.

Servo Controlled Turbine

Some readers may be interested in the water turbine which was shown being controlled in my article appearing the May issue of APPLIED HYDRAULICS. It is not a conventional type. I found information on this turbine while with the army of occupation in Ger-

Continued on page 16

Keeps Giant Swinging!



HOW 4 SMALL **TUTHILL** PUMPS OIL UP THE "MUSCLES" ON WORLD'S LARGEST SCOOP

Photo of The Mountaineer—courtesy of Marion Power Shovel Company, Marion, Ohio

To assure dependable flood lubrication on the swing gear units of this 2600-ton power shovel, Marion engineers selected Tuthill Model L positive displacement, internal-gear rotary pumps to do the job.

It was this type of Tuthill pump that pioneered the first practical mechanical seal for leak-free performance and low power consumption. Since 1927, hundreds of thousands of these compact small pumps have demonstrated their dependability to hold prime, deliver capacity needed, and operate quietly and uninterruptedly.

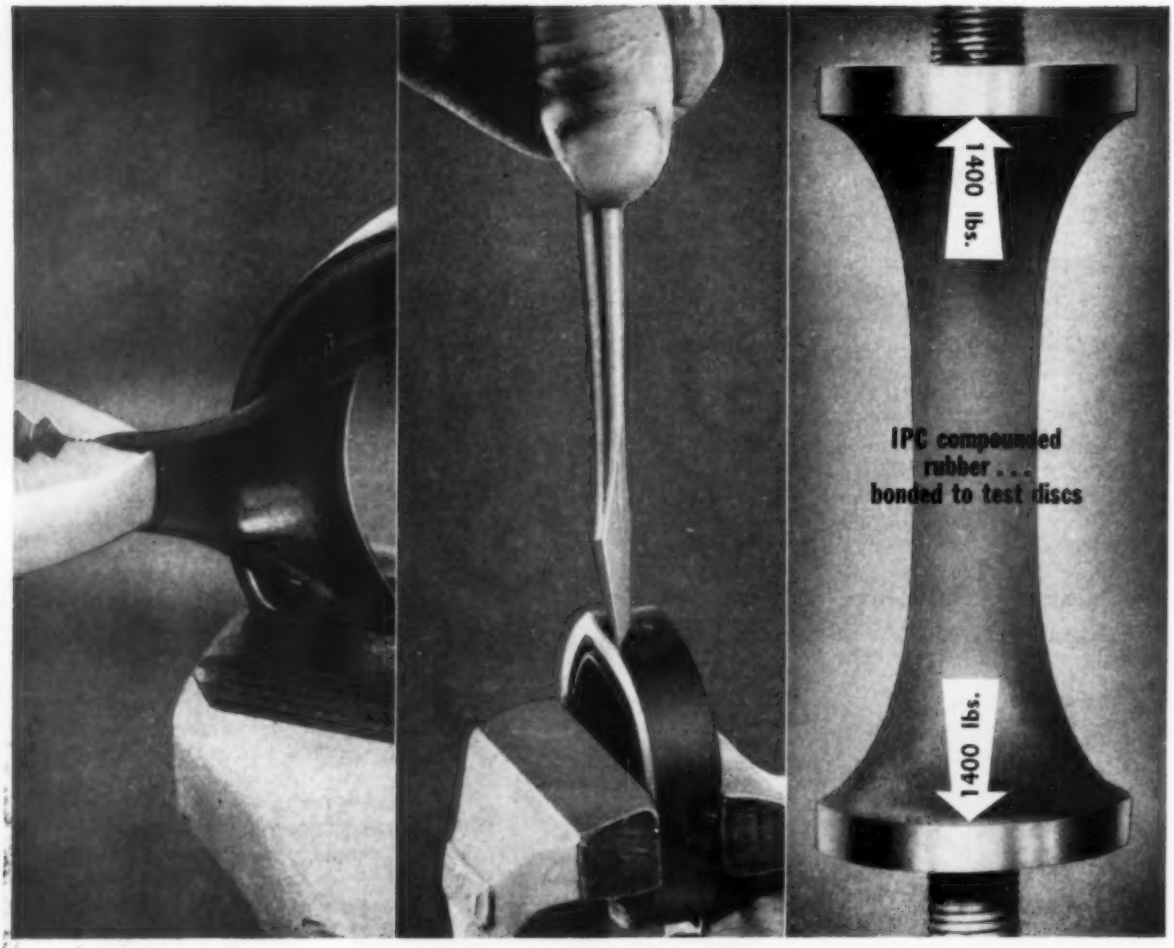
Whether your production calls for standard pumping units or special pumps for engineered applications in lubrication, coolant, hydraulic or liquid transfer service, you are invited to submit your specifications for recommendation.

Write for catalog data for lubrication or other specific needs.

See our catalog in Sweet's Product Design File 6b-Tu

TUTHILL PUMP COMPANY
Dependable Rotary Pumps . . . since 1927
939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada



TWIST IT . . . PRY IT . . . STRETCH IT

Bonded IPC Packings Stay Bonded

. . . Positive bonding — *rubber to metal.* More than a sticking process, the IPC bond is the result of a chemical affinity between these unlikely components. Here is a direct result of extensive laboratory testing.

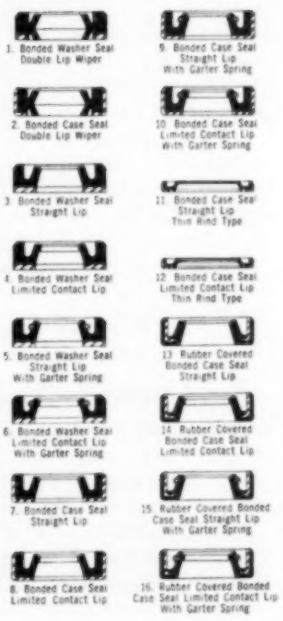
IPC bonded case seals and bonded washer seals combine the steel parts, held to very fine tolerances, with special rubber compounds. Whatever your sealing requirement, IPC will help with your oil seal or packings design . . . solve your problem with better manufacture.

Custom design means low cost plus dependability. Call IPC first for oil seals, packings and precision molded products.

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

BONDED BY IPC


1. Bonded Washer Seal Double Lip Wiper
2. Bonded Case Seal Double Lip Wiper
3. Bonded Washer Seal Straight Lip
4. Bonded Washer Seal Limited Contact Lip
5. Bonded Washer Seal Straight Lip with Garter Spring
6. Bonded Washer Seal Limited Contact Lip with Garter Spring
7. Bonded Case Seal Straight Lip
8. Bonded Case Seal Limited Contact Lip
9. Bonded Case Seal Straight Lip With Garter Spring
10. Bonded Case Seal Limited Contact Lip with Garter Spring
11. Bonded Case Seal Straight Lip Thin Rind Type
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
13. Rubber Covered Bonded Case Seal Straight Lip
14. Rubber Covered Bonded Case Seal Limited Contact Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

P4

Branch Offices: Chicago, Dallas, Detroit, Kansas City, New York, Philadelphia, San Francisco, St. Louis.

Circle 74 on Reader Service Card

ONE GOOD DESIGN DESERVES ANOTHER

Send for VALCOR Catalog
VALCOR Solenoid Valves are engineered for use in food vending machines, machine tools, chemical, food and drug processing industries, oil burners, air-conditioning, laundry machinery, air and hydraulic cylinders and other general industrial and fluid power applications.

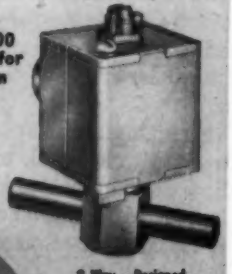
Series SV-300
2 Way Brass Body
Normally Closed. For use with water, oil, air and gases.
PIPE SIZES ⅛" or ¼" N.P.T.
Elec.: 115V-60 cy., 10 watts
Max. Pressure: 125 lbs.

Series SV-900
3 Way Brass Body
For use with water, oil, air and gases.
PIPE SIZES ¼" N.P.T.
Elec.: 115V-60 cy., 10 watts
Max. Pressure: 125 lbs.
Normally Closed or Normally Open

Series SV-1000
4 Way Brass Body
For use with water, oil, air and gases.
PIPE SIZES ¼" N.P.T.
Elec.: 115V-60 cy., 10 watts
Max. Pressure: 125 lbs.

Series SV-3600
2 Way Metal or Plastic Body
For use with hot and cold liquids—will handle extra heavy viscosities and large flows.
Male fittings for ⅜" I.D. Tubing
Elec.: 115V-60 cy., 10 watts
Max. Pressure: 100 lbs.
Normally Closed

Series SV-3500
Freon Valve for refrigeration



2 Way—Designed to take full back pressure.
Max. Pressure: 350 lbs.
This valve is manufactured in accordance with standard refrigeration specifications. Quotations on request.

VALCOR
SOLENOID VALVES

Incorporate VALCOR Solenoid Valves with the exclusive Floating Seal in the Systems you Design

Here's why: Every VALCOR Solenoid Valve is engineered with this unique and exclusive combination of features.

a) VALCOR'S Patented Floating Seal for 100% positive seal forward and backward.
b) Extremely low pressure drop.
c) Self-cleaning, self-lapping seal action that improves with use.
d) Greater capacities with smaller orifices.
e) Simplicity of design that guarantees high durability and long life even under extreme operating conditions, including heavy contaminent conditions.

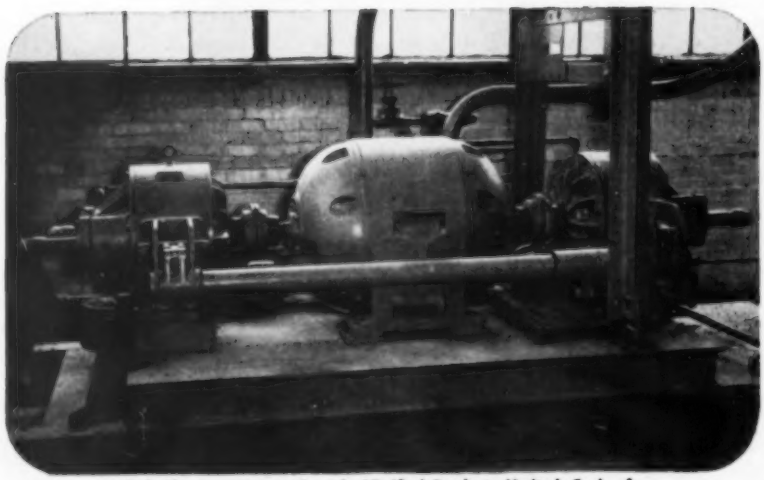
VALCOR Solenoid Valves afford top performance in every possible application. Design engineers in industry after industry are discovering the freedom of design that VALCOR Valves permit. Simplify your design problems. Write us for more information and tell us also about your problems.

VALCOR ENGINEERING CORPORATION
Carnegie Avenue, Kenilworth, New Jersey

Circle 136 on Reader Service Card

POWER FOR CLAY EXTRUSION PRESS SUPPLIED BY

AE HELE-SHAW PUMPS



Hele-Shaw pumps at Canada Vitrified Products Limited. Each of these pumps—size JHP-12—can deliver 44 gpm at up to 2500 psi.

ACROSS THE BORDER, Canada Vitrified Products Limited, St. Thomas, Ontario repowered an existing press with Hele-Shaw pumps to extrude vitrified clay sewer pipe and flue linings. This pumping unit furnishes dependable fluid power for all variations in ram speed and tonnage required for the many shapes and sizes of the finished product. It is remotely controlled by a single lever-operated hydraulic servo cylinder, controlling the amount and direction of flow of oil, in exact proportion to the operator's signal.

The famous Hele-Shaw is a radial-piston variable displacement fluid power generator. It can be very readily applied to the machine it serves...can be installed on the machine, near to it, remote from it, or integrated with the design itself.

Whenever you have a problem involving high pressure hydraulic systems, American Engineering Company may well be able to save both time and expense in planning and construction. Write for full information about the Hele-Shaw for variable displacement (pressures to 3000 psi) or the Hydramite for constant displacement (pressures to 5000 psi).

AMERICAN ENGINEERING COMPANY

DEPT. P-141, WHEATSHEAF LANE & SEPVIVA ST., PHILADELPHIA 37, PA.

Canadian Subsidiaries: Affiliated Engineering Corporations, Ltd., Montreal, P. Q.... Bawden Industries Ltd., Toronto, Ont.

AE products are: Taylor, Perfect Spread and Vibra-Grate Stokers, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers, Marine Deck Auxiliaries.

LETTERS to the editor

many and later designed it for the Fitz Water Wheel Company.

HANS W. HAMM
York, Pa.

Mr. Hamm's article detailed mechanical control of hydraulic servo valves which control position of a turbine flow regulating gate.

Master Catalog

We now have several copies of the Master Catalog of Fluid Power Products, 1956-1957 Directory. There is so much demand for copies that we have in Engineering, that I would like to obtain several more. From what I have seen, it would be of help to have one for my own use.

W. R. HARTMAN
Buyer
Philadelphia, Pa.
F. J. Stokes Machine Company

Additional copies of the catalog are available. Price per copy is $6.50.

Wants a Flow Switch

Please give us a list of manufacturers of flow switches suitable for use with oil.

Our problem is to find a flow switch that is reliable and will operate whenever a relief valve dumps. The flow switch will be used in the dump or tank line and will be subject to surge pressures to around 75 psi. Oil flow is 27 gpm., But we could bypass some and cut this figure down.

MALCOM ORR
Plant Engineering
Combustion Engineering, Inc.
Chattanooga Division

This is an application we have never come across. We assume that Mr. Orr wants an electrical "make" and "break" switch which will respond to flow off the relief valve. Not knowing what the electrical signal actuates it is difficult to suggest alternatives, for example a pressure switch. Perhaps a reader who has made a similar application of a flow switch can help Mr. Orr. ▼▼▼

Designers' Guide for Selection of Hose Lines

EXCELLENT

GOOD

CONDITIONAL

UNSATISFACTORY

This hose selector chart plus other engineering data is included in Aeroquip Catalog No. 200. Write for your copy today.

TYPE OF FLUID	AEROQUIP HOSE NUMBER	1501	1501B	1502 (Buna N)	1502 (Neop.)	1503 (Buna N)	1503 (Neop.)	1508	1509 (Buna N)	1509 (Neop.)	1509A (Neop.)	1513	1524	1525	1531	1532	1533 (Buna N)	1533 (Neop.)	1534	1538	1540	1541	1546	1547	2556	2650	2651	2750
Acetic Acid (conc.)		□	□	□	□	□	□	□	□	□	□	□	●	□	□	●	□	□	□	□	□	□	●	□	□	□	□	●
Acetic Acid (dil.)		□	●	●	□	●	□	□	●	□	□	●	●	●	□	●	●	□	●	●	●	□	●	●	●	●	●	●
Acetone		○	□	○	○	○	○	○	○	○	○	○	●	○	○	●	○	○	○	○	□	○	●	○	○	○	○	●
Acetylene		□	●	□	□	□	□	□	□	□	□	□		□	□	●	□	□	□	□	●	□	●	□	□	□	□	
Air		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Air, Hot		□	□	□	□	□	□	□	□	□	□	□		□	□	●	□	□	□	□	□	●	□	□	□	□	□	
Alcohols, Aliphatic		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Ammonia, Anhydrous		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Ammonia, Aqueous		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Ammonia Gas		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Asphalt		○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Benzene (Benzol)		○	□	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	□	○	○	○	○	○	○	○	○	○
Butane		●	●	●	●	●	●	●	●	●	●	●		●	●	○	●	●	●	●	●	○	●	●	●	●		
Carbolic Acid (Phenol), Hot		○	□	□	○	□	○	○	□	○	○	□	●	□	○	□	□	○	□	□	□	○	□	□	□	□	□	●
Carbon Dioxide (dry)		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Chlorinated Solvents		○	□	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	□	○	○	○	○	○	○	○	○
Chlorine (dry)		□	□	□	□	□	□	□	□	□	□	□	○	□	□	□	□	□	□	□	□	□	□	□	□	□	□	○
Chlorine (wet or solutions)		○	○	○	○	○	○	○	○	○	○			○	○	○	○	○	○	○	○	○	○	○	○	○	○	
Creosote Oil		□	□	□	□	□	□	□	□	□	□	□		□	□	○	□	□	□	□	□	○	□	□	□	□	□	
Diesel Fuel		●	●	●	●	●	●	●	●	●	●	●		●	●	○	●	●	●	●	●	○	●	●	●	●		
Ethers		□	●	●	□	●	□	□	●	□	□	●	○	●	□	□	□	●	●	□	●	□	●	●	□	□	●	○
Freon 12, 13		□	●	●	□	●	□	□	●	□	□	□	●	●	□	□	●	□	●	□	●	□	□	□	●	□	□	●
Fuel Oil		●	●	●	●	●	●	●	●	●	●	●		●	●	○	●	●	●	●	●	○	●	●	●	●		
Furfural		□	□	□	□	□	□	□	□	□	□	□	○	□	□	○	□	□	□	□	□	□	○	□	□	□	□	○
Gasoline, Refined		●	●	●	●	●	●	●	●	●	●	○	○	●	●	○	●	●	●	●	●	○	●	●	●	●	●	○
Gasoline, Sour		●	●	●	●	●	●	●	●	●	●	●		●	●	○	●	●	●	●	●	○	●	●	●	●		
Hydraulic Oil		●	●	●	●	●	●	●	●	●	●	●		●	●	○	●	●	●	●	●	○	●	●	●	●		
Hydrogen		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●		
Hydrolube		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●		
Kerosene		●	●	●	●	●	●	●	●	●	●	●		●	●	○	●	●	●	●	●	○	●	●	●	●		
Ketones		○	□	○	○	○	○	○	○	○	○	○		○	○	●	○	○	○	□	○	●	○	○	○	○		
Lacquers and Solvents		○	□	○	○	○	○	○	○	○	○	○	○	○	○	□	○	○	○	□	○	□	○	○	○	○	○	○
Lindol, Cellulube		○	○	○	○	○	○	○	○	○	○			○	○	●	○	○	○	○	○	●	○	○	○	○		
Lube Oil (hot)		●	●	●	●	●	●	●	●	●	●	●		●	●	○	●	●	●	●	●	○	●	●	●	●		
Mercury		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●		
Mineral Oil		●	●	●	●	●	●	●	●	●	●	○		●	●	○	●	●	●	●	●	○	●	●	●	●		○
Naphtha		●	●	●	●	●	●	●	●	●	●	○		●	●	○	●	●	●	●	●	○	●	●	●	●		○
Naphthalene		□	□	□	□	□	□	□	□	□	□	●	○	□	□	●	□	□	□	□	□	●	□	□	□	□		○
Natural Gas		●	●	●	●	●	●	●	●	●	●			●	●	○	●	●	●	●	●	○	●	●	●	●		
Oxygen		●	●	●	●	●	●	●	●	●	●			●	●	○	●	●	●	●	●	○	●	●	●	●		
Propane		●	●	●	●	●	●	●	●	●	●	○		●	●	○	●	●	●	●	●	○	●	●	●	●		○
Pydraul F-9		○	○	○	○	○	○	○	○	○	○	●		○	○	●	○	○	○	○	○	●	○	○	○	○		●
Steam		○	○	○	○	○	○	○	○	○	○	●		○	○	□	○	○	○	○	○	□	○	○	○	○		●
Trichlorethylene		○	●	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	□	○	○	○	○	○	○		○
Toluene (Toluol)		○	□	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	□	○	○	○	○	○	○		○
Water, Fresh and Salt (cold)		●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●		●
Water, Fresh and Salt (hot)		○	●	●	○	●	○	○	●	○	○	●		●	●	○	●	●	●	●	●	○	●	●	●	●		●

Engineering assistance available to manufacturers.

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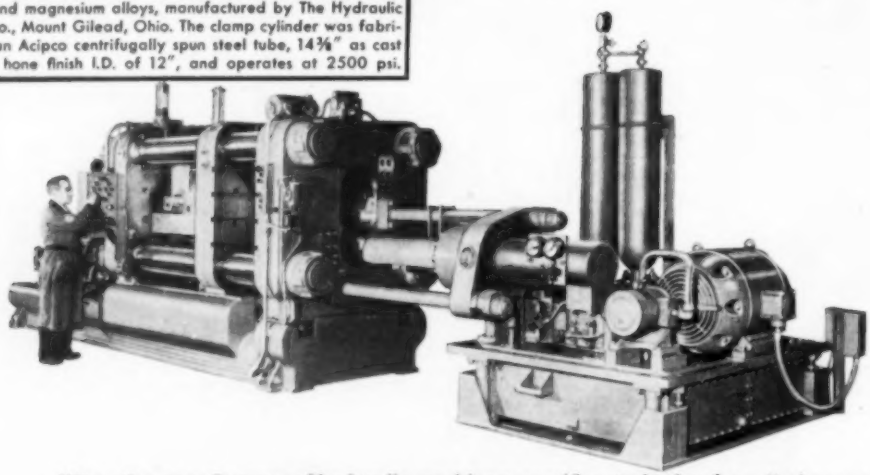
ACIPCO Centrifugally Spun STEEL TUBES

H-P-M 800-ton cold chamber die casting machine for casting aluminum, brass and magnesium alloys, manufactured by The Hydraulic Press Mfg. Co., Mount Gilead, Ohio. The clamp cylinder was fabricated from an Acipco centrifugally spun steel tube, 14⅜" as cast O.D. with a hone finish I.D. of 12", and operates at 2500 psi.

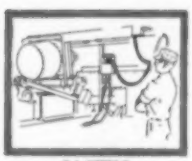


When the manufacturer of hydraulic machinery specifies steel tubes for cylinders, you can be sure he has considered *all* the requirements for the cylinders with more than just ordinary attention.

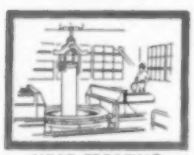
Hydraulic cylinders must withstand extreme pressures and rugged use over long periods. To meet these conditions, tubes must possess high strength physical properties and be of a dense, homogenous metal structure, free from any porosity. They must be made of steel of an exact alloy analysis.

And, from a purely economic point of view, these tubes must be reasonably priced . . . or offer a *distinct price advantage*.

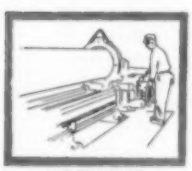
The Hydraulic Press Manufacturing Company of Mount Gilead, Ohio, used Acipco heavy wall steel tubing in this 800-ton die casting machine. Many other manufacturers, as well, are calling on Acipco's complete, integrated facilities and production "know-how" for steel tubes which offer low cost, high quality and peak performance.



CASTING

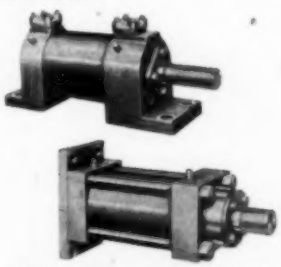


HEAT TREATING



MACHINING

Acipco centrifugally spun steel tubes are produced in a wide range of sizes up to 16' lengths, with longer lengths furnished by welding tubes together. Outside diameters are from 2.25" to 50" and wall thicknesses from .25" to 4". All alloy grades, including heat and corrosion-resistant stainless steel, and plain carbon grades can be supplied. Special analyses are also available. Acipco centrifugally spun tubes can be furnished as cast, rough machined or finish machined, including honing. In large heavy wall sizes, Acipco steel tubes offer decisive price advantages over hollow-bored forgings.



Acipco centrifugally spun tubes are used successfully in many other types of hydraulic cylinder applications. Write, wire or call Acipco for complete information.

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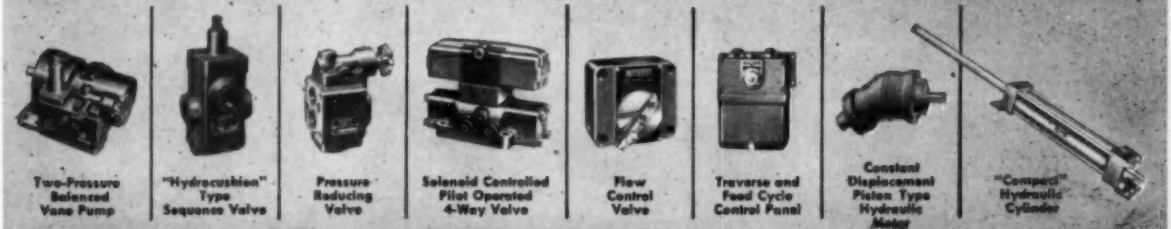
Representative Standard VICKERS Units Used on LeBlond Automated Crankshaft Lathe



Two-Pressure Balanced Vane Pump | "Hydrocushion" Type Sequence Valve | Pressure Reducing Valve | Solenoid Controlled Pilot Operated 4-Way Valve | Flow Control Valve | Traverse and Feed Cycle Control Panel | Constant Displacement Piston Type Hydraulic Motor | "Compact" Hydraulic Cylinder

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

BRIEFS about fluid power

NATIONAL FLUID POWER ASSOCIATION . . . 1956 SPRING MEETING

Panel discussions emphasize marketing techniques . . . selection of management consultants . . . Profit sharing plans, business ethics and BDSA are major topics . . . Technical board plans product surveys.

This panel discussed: "Direct Selling vs Distributor Selling". Speaker is Carl Abbott, J. N. Fauver Co. To his right are W. R. Lockridge, New York Air Brake, and Henry A. Schultz, Racine Hydraulics. Denison Neale, The Denison Engineering Co., and Henry Fielding, Pesco Products Div. complete the panel.

Ray Murphy, New York Air Brake, was program chairman. To his right are J. E. Erskine, Racine Hydraulics & Machinery, Inc., and Ellwood G. Peterson, Hannifin Corporation.

THE National Fluid Power Association held their third annual spring meeting May 28-30 at The Greenbrier, White Sulphur Springs, W. Va. Approximately one hundred members and guests were rewarded by an outstanding program which featured two panel discussions, one on the problem of direct selling vs. distributor selling, the other on the selection and use of management consultants.

"Direct Selling vs. Distributor Selling" was a panel discussion presented by the Marketing Board and presided over by W. R. Lockridge, Marketing Manager of the New York Air Brake Company. Two panelists, Denison Neale, Assistant Director of Sales, The Denison Engineering Company and Henry Fielding, Industrial Sales Manager, Pesco Products Div., Borg-Warner Corporation, presented the case for direct selling. Mr. Neale outlined in detail the facilities and operation of a stocking factory branch and Mr. Fielding gave the "home office" viewpoint of the control of a manufacturer's direct sales operation.

Henry A. Schultz, Vice President, Racine Hydraulics and Machinery, Inc. and Carl S. Abbott, President, The J. N. Fauver Co., Inc., of Detroit, presented the case for distributor selling. Mr. Schultz's company has always used distributor organizations as the major factor in their sales; Mr. Abbott, as the head of a large and very successful distributor organization, emphasized the added services

Continued on page 22

Bet your boots we make 'em

Steering knuckle drag link boot
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Whether you want a boot two stories high . . . or no bigger than your thumb . . . let C/R Sirvis engineers solve the problem for you. They're specialists . . . backed by 78 years' experience . . . with unusual skills and ingenuity in the development and manufacture of mechanical boots. They'll design and produce a C/R Sirvis boot to your exact requirements in any size, any quantity . . . using only the finest materials: mechanical leather, selected, tanned and treated by C/R . . . nylon . . . or elastomer-coated fabric. The absolute dependability of your boot will be proved before production.

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BRIEFS continued

David Fromson, Greer Hydraulics Inc., spoke on the subject of "Business Ethics or Government Controls—a Continuous Choice". To his right is Arthur F. Jensen, Hanna Engnieering Works, who is chairman of the association's Management Services Board.

Activities of the Technical Board were reported by Walter J. Kudlaty, Miller Fluid Power Div.; Otto J. Maha, Hannifin Corp.; and Allen W. Churchill, Automatic Switch Co. (right to left)

which a distributor is in the position to give to his customers. He listed service, quality, availability and price as advantages. He pointed out that the trend toward "package" buying was in the distributor's favor; that 60 percent of distributors use their own catalogs, maintain better lists than it is possible for a manufacturer and that 25 percent of distributors maintain their own service shops.

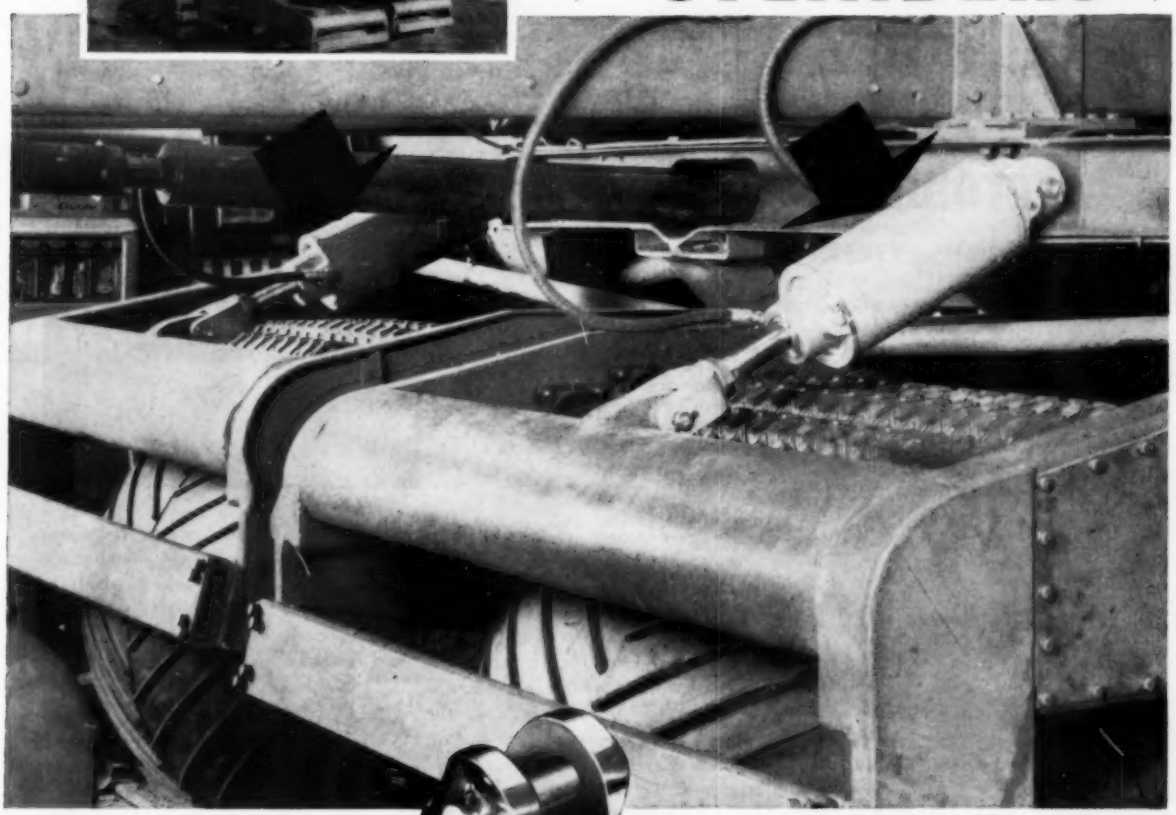
How to Select and Use Management Consultants" was the second panel discussion. J. G. Jones, Vice President and General Manager of A. W. Cash Company presided. Three phases of consulting services—top management, manufacturing management and sales and marketing management were presented. E. B. Maple, Vice President, Barrington Associates of New York City, outlined the services available for top management, including the training of top drawer personnel. W. K. Hodson, Vice President, Methods Engineering Council, Pittsburgh, in his address "Manufacturing Management" gave some excellent case histories to illustrate the specific assistance that can be used by production executives. R. F. Dick, Vice President, Illinois Tool Works, Chicago, outlined some of the questions that the manufacturer should ask of a consultant in his talk "Sales and Marketing Management."

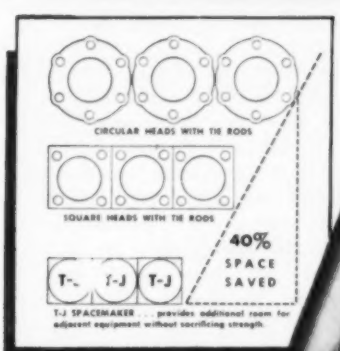
Marketing Projects: At the first morning session, after the officers' reports were given, Mr. Lockridge, in his Marketing Board Report touched upon a number of projects—buying perferences, including replacement practices, background and compensation of salesmen, sales organizations and costs, government business and new markets. Some of these projects are underway; the last, on new markets, is to be developed later. A long range business forecast service is also planned as a service to members.

This session was closed by a visual and sound presentation of one of the outstanding merchandising programs yet developed in the industry. John E. Goldring, President, Modernair Corporation of San Leandro, Calif., outlined

Continued on page 24

Arctic Cargo Carrier Depends On T-J *Spacemaker* CYLINDERS

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T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Saves 40% Space!
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Differential axle loading through T-J Spacemaker Air Cylinders forms a controlled walking beam in this Teracruiser, designed and produced for the Army Ordnance Corps by the Four Wheel Drive Co., Clintonville, Wis.

Weight of cylinders was important factor in choosing T-J Spacemakers, which reduce weight while providing same displacement and extra high safety factor. Fast delivery and space-saving features also favored T-J. Exclusive with T-J are new Super Cushion Flexible Seals for Air (to 200 P.S.I.) . . . and New Self-Aligning Master Cushion for Oil (to 750 P.S.I.). Hard chrome plated bodies and piston rods are standard, at no extra cost. Wide range of styles, capacities . . . 64,000 combinations *off the shelf!* Write for bulletin SM-155-3. The Tomkins-Johnson Co., Jackson, Mich.

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Primary Oil Pumps • Vacuum Powered Transmission and Low Pressure Air Service • Air and Liquid Filters •

What's your problem?

- higher pumping speeds?
- tolerance of particle-laden liquids?
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Is unmatched for dependable performance on every one of those counts.

Bulletin A-1330 has full data . . . write for it. The roller-rotor design easily handles particles that would jam more tightly-fitted mechanisms—reduces cavitation, allowing higher speed operation*—develops high suction characteristics.

*Roller mechanisms permit higher speeds with any oil than most displacement designs.

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BRIEFS continued

L. L. Charlson, Char-Lynn Company, welcomed new members of the association. At his far left is John J. Pippenger, Double A Products who was elected president of the association for the coming year.

Between sessions, Carl Abbott of J. N. Fauver Company, M. C. Nelson and L. S. Barksdale of Barksdale Valves, and Wilson H. Cole of Simplex Engineering discuss the program.

the development of their Fluid Power Merchandising Manual, then displayed the slide and wire recorder presentation of the program which is used by his own sales, dealer and distributor organization. Members displayed considerable interest both in the planning of the program and in the equipment used in the presentation.

Management Services Board reports: Chairman Arthur F. Jensen introduced Education Chairman John C. Hanna, Public Relations Chairman R. J. Murphy; Industrial Relations Chairman J. G. Jones and Government Relations Chairman David Fromson, each of whom gave brief reports. However, a greater part of the session was devoted to three papers. Mr. Fromson read "Business Ethics or Government Controls". His thesis was that a self-imposed code of business practice was preferable to a rigid control such as a government might impose.

James W. Anderson, Business and Defense Services Administration (BDSA), outlined the business services of BDSA and went into some detail on the progress which the Government Relations Committee of NFPA has made with the classifications of products for census and emergency priority purposes. Most of the fluid power products made by members are now classified into three divisions: (1) General Components (valves, fittings, power transmission equipment, etc.); (2) General Industrial Equipment (pumps, compressors, plant machinery, etc.); (3) Power Equipment (pipe, heat exchangers, etc.).

Tom Kent, Director of Personnel, Daisy Manufacturing Co., Detroit, gave the third paper on "Profit Sharing". He presented the plan of profit sharing which has operated successfully for 10 years in his company. He pointed out that profit sharing plans are very diverse and are tailored to each company's peculiar conditions.

Technical Board reports: Technical Board Chairman W. J. Kudlaty and board members Otto J. Maha and Allen W. Churchill covered Terminology, Symbols, Fluids, Coding, Rating and Dimensions. A good beginning has been made on Terminology but

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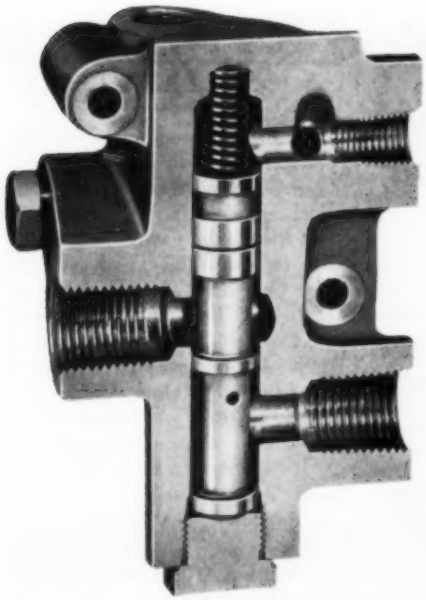

NEW Webster Flow Divider

THE MOST ECONOMICAL ANSWER FOR POWER STEERING

and other dual applications

WEBSTER'S NEW FLOW DIVIDER is a specially developed flow control valve specifically designed to provide the utmost economy in power steering and other applications where two separate hydraulic power circuits are to be served. It has been used with great success on agricultural equipment, road-building machinery, materials-handling equipment, and for many other purposes. Its advantages include:

Greatest Economy • Use of the Flow Divider eliminates any necessity for a second hydraulic pump and driving medium—cuts equipment and installation costs substantially.

Less Hydraulic Piping • Use of the Flow Divider simplifies and reduces the amount of hydraulic piping required, since it eliminates the inlet piping which would be required for a separate pump, and it can be installed close to the secondary demand.

Flexibility • The Flow Divider can be installed remotely from the pump, thus providing greater flexibility in the design of hydraulic circuits.

Compactness • The small size (2″x 3″x 5½″) of the Flow Divider eliminates installation problems.

In most applications the Flow Divider is adjusted to provide constant flow to the secondary system. For example, in power steering applications 2½ gpm are constantly diverted to the steering circuit. However, Flow Dividers can also be adjusted to allot pump capacity proportionately between primary and secondary circuits.

The Flow Divider has a capacity of up to 20 gpm at 2000 psi. A built-in damping device prevents noise, eliminates "hunting" effect. It can be provided with a built-in relief valve, if desired.

TANDEM PUMP COMBINATIONS

For those dual applications where you want two pumping units, Webster's Tandem Pump Combinations provide an economical, completely dependable answer. Rated at 1000 psi and 1750 rpm, these combinations are provided with a capacity range for the larger pump from 4.8 to 29.0 gpm. The small pump has a capacity range from 1.0 to 4.0 gpm.

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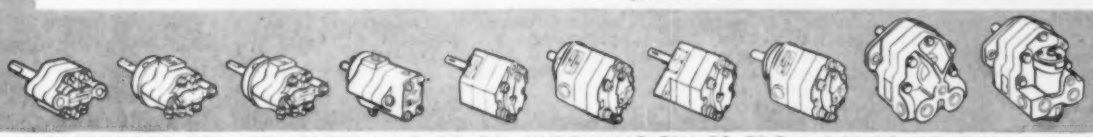

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for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

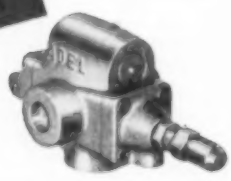
GEAR-TYPE HYDRAULIC PUMPS

For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES

4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

RELIEF VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

COMPENSATED CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES

Valves allow free flow in one direction only. Many variations available. 3000 psi.

For complete engineering specifications and counsel, Address: ADEL PRECISION PRODUCTS, DIVISION OF GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

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Circle 2 on Reader Service Card

BRIEFS / continued

Chairman Hyman Ledeen could not report because of illness. Allan Churchill reported briefly on the work of the Ratings Committee and Otto Maha gave a short progress report on the cylinder dimension Committee's work. Fuller reports will be made at the Fall meeting. Most of the personnel of these Committees will continue to serve until the Fall meeting.

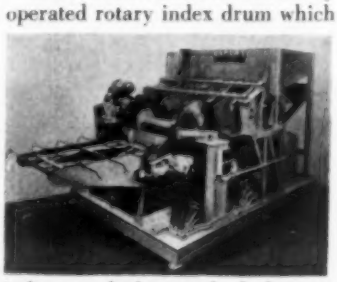
The meeting was closed by an election of officers and directors. J. J. Pippenger was elected President for the coming year; R. J. Murphy, first Vice President; J. A. Marsh, second Vice President; and E. G. Peterson, Treasurer. Four new Directors were named: G. R. Pittman, J. R. McGuire, Wm. C. Richards, Jr., and S. B. Taylor.

The Fall meeting of NFPA will be held October 30-Nov. 1 at the Hotel Cleveland, Cleveland, Ohio. ▼▼▼

Hydraulic Rotary Actuators Speed Bending Operation

Inner and outer bends on steel rods are produced at rates up to 960 rods per hour on an automatic bending machine, built by Expert Automation Machine Co.

The machine has a mechanically operated rotary index drum which



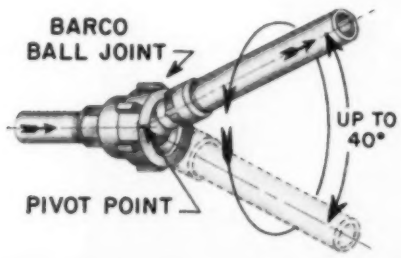
indexes rods from a feed chute to two bending stations. These bends are produced by bending dies, powered by single rotation, hydraulic rotary actuators. Each of the four rotary actuators which power these bending dies are slide-mounted and moved in and out of bending position by a hydraulic cylinder. The actuator and slide assemblies are cradle-mounted to provide adjustable bend angles

Continued on page 30

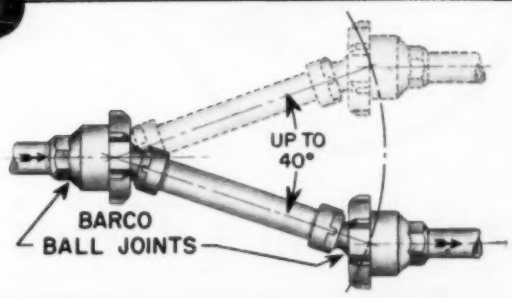
Barco Flexible Ball Joints

for solving piping problems { MOVEMENT • ALIGNMENT • EXPANSION CONTRACTION • VIBRATION • SHOCK

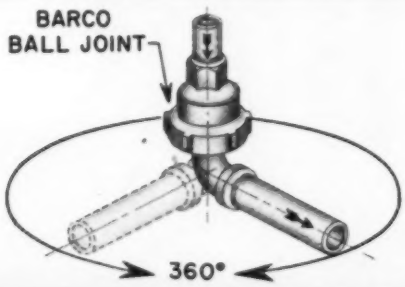
BARCO



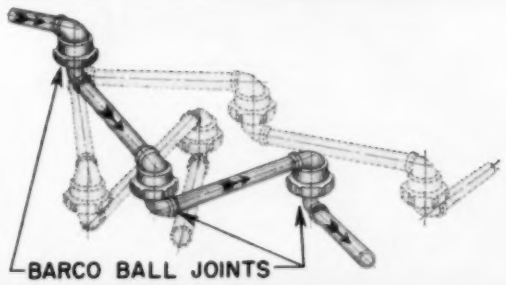
ONE JOINT—Provides for angular motion or positioning of piping in any plane. (Also see below.)



TWO JOINTS—This arrangement provides for piping alignment or simple flexible connection.



ONE JOINT—Allows for full 360° swivel or swing motion, in addition to angular movement shown above.



THREE (OR MORE) JOINTS—For complete flexibility. Any angle! Any radius! Any plane! Many arrangements possible.

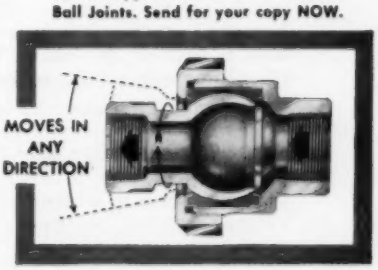
For Use by Design Engineers

THE four basic principles of motion illustrated above make the BARCO Flexible Ball Joint one of the most useful, most versatile fittings ever developed for piping conveying chemicals, oil, steam, water, air, and countless other fluids. *One joint often does the work of two or more ordinary swivel joints, because it moves in any direction!*

Metal pipe made flexible with Barco Flexible Ball Joints is practically indestructible. Long range planning calls for the permanence of this type of construction—*for freedom from maintenance and replacement, and SAFETY!*

There are many applications for Barco Flexible Ball Joints in industry: (1) To permit movement, (2) To accommodate expansion and contraction, (3) To provide for alignment, (4) To insulate against vibration and shock. For piping up to 12". Wide choice of styles and materials. *Let us give you the complete story.*

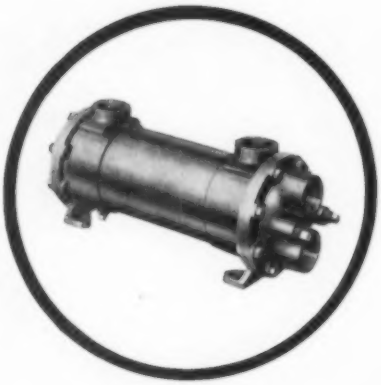
GET THE FACTS—New Catalog 2158 is an interesting, illustrated handbook on the application of Barco Flexible Ball Joints. Send for your copy NOW.



BARCO *Manufacturing Co.*

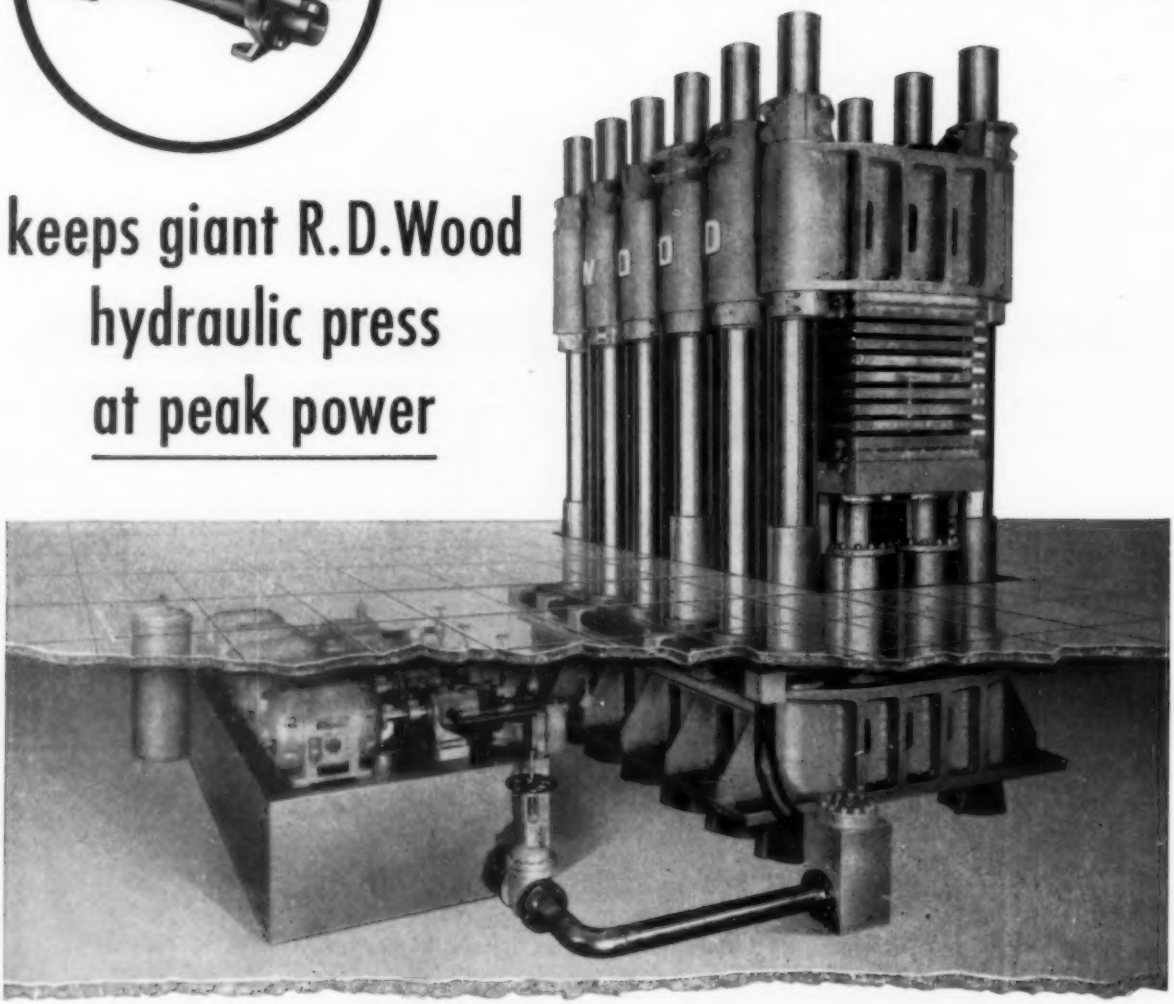
532H Hough Street • Barrington, Illinois

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING, AND REVOLVING JOINTS



ROSS EXCHANGER

keeps giant R.D.Wood hydraulic press at peak power



Producing hardboard by the dry process for a large west coast manufacturer, this multiple opening, 8300-ton R. D. Wood hydraulic press has steam platens measuring 54″ x 200″ with steam pressure of 750 psig.

To maintain peak capacity of the hydraulic power system, a Ross Type BCF Exchanger was furnished as original equipment. Oil in the sump tank is kept at the correct viscosity to insure the ultimate in press performance.

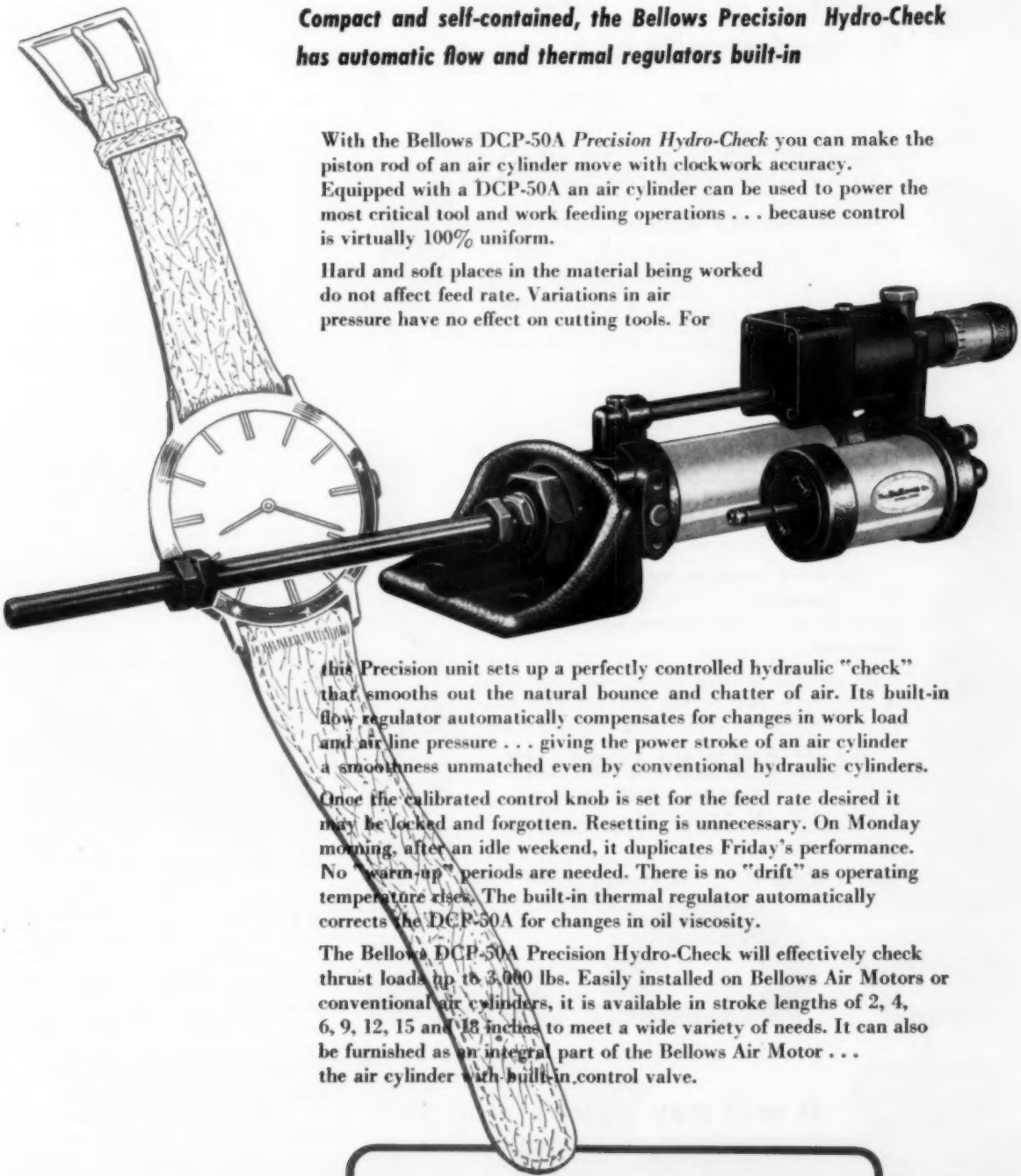
Preferred for numerous types and makes of hydraulic machinery, Ross Exchangers are chosen for their high thermal efficiency, compactness and ease of installation. They have the ruggedness to withstand hydraulic pressure surges and are practically maintenance-free. Pre-engineered and completely standardized, they're available in a wide range of sizes to meet most requirements.

For additional information, request Bulletin 1.1K5. Write. Ross Heat Exchanger Division of American-Standard, 1464 West Avenue, Buffalo 13, N. Y. In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

ROSS | ROSS HEAT EXCHANGER PRODUCTS

This hydraulic unit controls air cylinder movement with *21-Jewel Precision*

Compact and self-contained, the Bellows Precision Hydro-Check has automatic flow and thermal regulators built-in



With the Bellows DCP-50A *Precision Hydro-Check* you can make the piston rod of an air cylinder move with clockwork accuracy. Equipped with a DCP-50A an air cylinder can be used to power the most critical tool and work feeding operations . . . because control is virtually 100% uniform.

Hard and soft places in the material being worked do not affect feed rate. Variations in air pressure have no effect on cutting tools. For this Precision unit sets up a perfectly controlled hydraulic "check" that smooths out the natural bounce and chatter of air. Its built-in flow regulator automatically compensates for changes in work load and air line pressure . . . giving the power stroke of an air cylinder a smoothness unmatched even by conventional hydraulic cylinders.

Once the calibrated control knob is set for the feed rate desired it may be locked and forgotten. Resetting is unnecessary. On Monday morning, after an idle weekend, it duplicates Friday's performance. No "warm-up" periods are needed. There is no "drift" as operating temperature rises. The built-in thermal regulator automatically corrects the DCP-50A for changes in oil viscosity.

The Bellows DCP-50A Precision Hydro-Check will effectively check thrust loads up to 3,000 lbs. Easily installed on Bellows Air Motors or conventional air cylinders, it is available in stroke lengths of 2, 4, 6, 9, 12, 15 and 18 inches to meet a wide variety of needs. It can also be furnished as an integral part of the Bellows Air Motor . . . the air cylinder with built-in control valve.

FOR COMPLETE INFORMATION ON BELLOWS HYDRO-CHECKS WRITE DEPT. AH 756

The Bellows Co.
AKRON 9, OHIO

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for best results at
lowest costs . . . specify
PAGE PACKINGS
Here are packings especially engineered to give you long life with a minimum of maintenance. Page Leather Packings are tough, pliable, highly resistant to abrasion and wear; made from various leathers with specific treatments and impregnations for each particular application.
Packings may look much alike, but with Page Packings you can really save, for with these expertly made packings you also get the sincere interest and willing helpfulness of a group of experienced packing engineers . . . backed up by an old, dependable company with over 87 years of packing know-how.
Page has a complete line of Standard Synthetic Packings . . . U's, V's, Cups, Flanges and O-Rings . . . for various applications and pressures.
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It will pay you to specify
PAGE PACKINGS
Engineered to do a better job

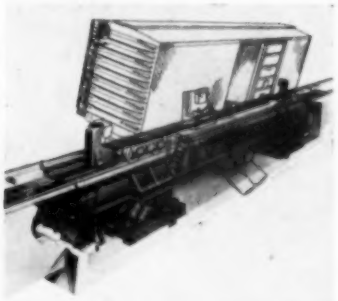
BRIEFS continued

and plane relationships. Hydraulic power for the rotary actuators and slide control cylinders is provided by a compact hydraulic power unit at the rear of the machine. Two vane-type pumps in the unit are powered by one 7½ hp motor. One pump powers the actuators and slide for the first bending operation, the other powers the second bending operation. Power for the drum index is supplied by a 1 hp motor. Automatic machine cycle is pushbutton controlled. ▼▼▼

Fluid Power Assures Steady Flow

By means of a gentle oscillating motion a railroad boxcar weighing 150,000 pounds can now be emptied of grain or other free-flowing bulk material at the rate of four car loads per hour.

The entire unit, known as Kar-Flo—developed by Link-Belt Company—can be installed in a pit 7 feet 3 inches deep. The visible



portion of the steel structure consists of a pair of rails mounted on a platform next to the receiving hopper and an operator's platform with control center. To produce the necessary 8 degrees side tilt, the rail furthest from the operator's platform is 8 inches higher.

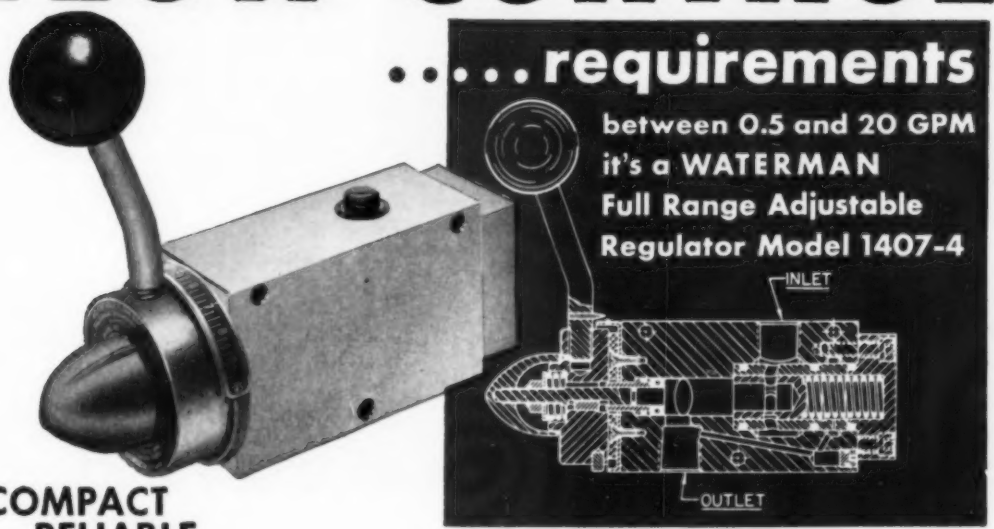
When a boxcar is positioned on the unloading platform, two hydraulically operated end clamps rise from between the rails, move toward the ends of the car, center it and lock it securely to prevent endwise movement. Car door on the unloading side is opened, the

Continued on page 32

FOR YOUR
FLOW CONTROL

....requirements

between 0.5 and 20 GPM
it's a WATERMAN
Full Range Adjustable
Regulator Model 1407-4



COMPACT
RELIABLE
RUGGED

- Minimum to maximum flow adjustment obtained by 180° handle rotation.
- Flow rate changes easily accomplished under any conditions of pressure or back pressure.
- Adjustable handle tension eliminates need for wrenches and locking levers for changes in flow setting.
- Ideally suited for installations requiring frequent changes in operating speeds or throttling control during the machine cycle.
- Choice of control—either right or left rotation of control handle.
- Multiple control—with right and left hand rotation operator can control two operations simultaneously.
- Aluminum bodies housing steel working parts provide light weight units for easy handling and installation.

LOOK TO WATERMAN FOR THE ANSWER TO YOUR FLOW CONTROL REQUIREMENTS

Write for latest illustrated bulletin A

WATERMAN
ENGINEERING COMPANY

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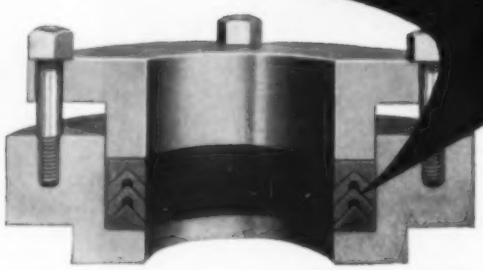
Circle 140 on Reader Service Card

ONE OF THE GARLOCK 2,000

SHALLOW STUFFING BOXES NEED THIS KIND OF "GRIP"



GARLOCK
431 CHEVRON* PACKING

tightens as pressure increases, eases off as pressure decreases, assuring no-leak sealing and minimum friction on rams, plungers, reciprocating rods, etc.

LOOK AT THESE SERVICE REPORTS:

- On hydraulic press with 40" dia. ram, operating at 6000 psi pressure, .006" clearance between ram and gland, GARLOCK 431 CHEVRON size 40" x 41½" by only 2" deep gave 14 years service.
- On hydraulically operated clutches with ¾" cylinder, 500 psi pressure, ¾" travel, operating intermittently. Neither leather cups nor "O" rings worked well. Now packed with GARLOCK 431 CHEVRON ⅜" x ¾" x 17/32" deep. Result: smooth, positive sealing.

And remember, 431 CHEVRON Packing is only one of "the famous GARLOCK 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet *all* your needs. It's the *only* complete line . . . it's one reason you get unbiased recommendations from your GARLOCK representative. Call him today or write for Folder AD-115.

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Palmyra, New York

For Prompt Service, *contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.*

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

BRIEFS continued

inner door removed, locks on the platform are then released and the drive is started by pushbutton. Rotation of counterweights produces an oscillating motion of 140 strokes per minute.

A 15 hp hydraulic system powers the platform locks and the car clamps. Only a 25 hp motor is required for the main drive, because the balanced car platform utilizes the natural frequency action of 2½ inch diameter wide coil springs. ▼▼▼

Fluid Power At The 1956 B.I.F.

Latest developments in the hydraulic and pneumatic industries were shown at this year's heavy engineering section of the British Industries Fair, held at Birmingham, England, April 23—May 5.

Reilly Engineering Co., Ltd., showed the application of a fluid power drive to a high speed grinding head capable of revolving at a speed up to 148,000 rpm. This spindle was powered by a Plessey hydraulic pump delivering oil at 750 psi to a small turbine head incorporating fluid bearings.

A wide range of hydraulic components for trucks and earth-moving equipment was shown by the Edbro-B & E Tippers Ltd. Among these was a heavy duty gear pump for pressures up to 2,000 psi at 1100 rpm at a delivery of 38 gpm.

A new development in the heavy duty pump-motor field was exhibited by J. Lucas Ltd. This new pump is of the axial-plunger type, cam-plate operated. Variable speed delivery is provided by a lever which alters the angle of the cam-plate-and thus the stroke of the pistons—from 0 to 20 degrees either side of the perpendicular. Two models are available.

Probably the most interesting development was exhibited by the National Institute of Agricultural Engineering. This is believed to be the first occasion on which

Continued on page 34

Circle 51 on Reader Service Card

Circle 6 ⟶

How can you afford ordinary gear type couplings when AJAX NEW 3-D Degree DIHEDRALS HANDLE 3 DEGREE MISALIGNMENT at the same low price?

With ability to handle angular and offset misalignment...with minimum backlash... with perfected lubricant sealing...with long life,—Ajax Dihedral Couplings have made ordinary couplings obsolete.

And now AJAX adds this new 3-D Self-aligning Dihedral Coupling at prices competitive with ordinary gear type couplings.

Features of the new Ajax 3-D Dihedral Coupling include:

3 degree misalignment capacity.

Load is distributed at center of teeth at the point of greatest strength.

More tooth strength is provided under misalignment than is possible with any other tooth shape.

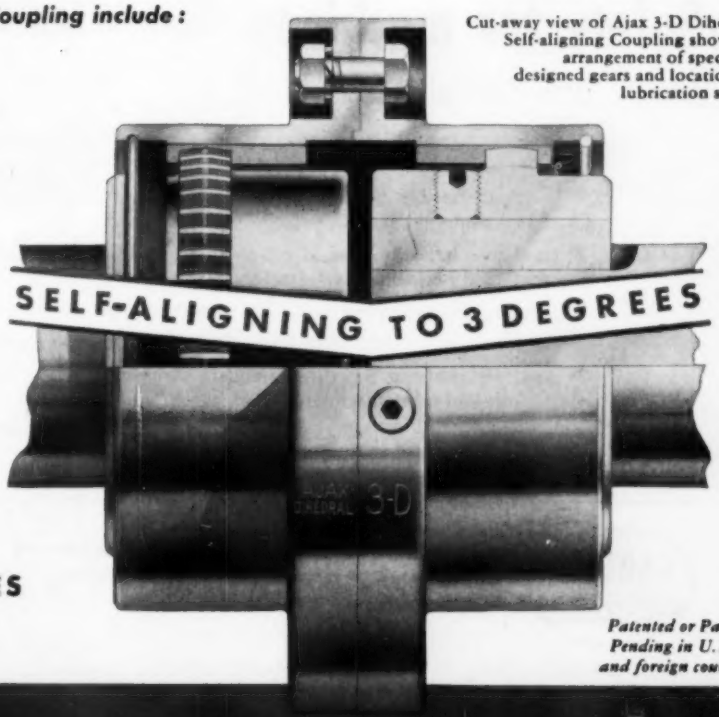
Exclusive Ajax Dihedral tooth design has less clearance than conventional gear type couplings.

No end-of-tooth wear under misalignment. Johns-Manville "Clipper" seals keep lubricant in and foreign matter out.

Compact overall size.

Designed for NEMA motors with standard keys.

Low prices competitive with ordinary gear type couplings.



Cut-away view of Ajax 3-D Dihedral Self-aligning Coupling showing arrangement of specially designed gears and location of lubrication seals.

AVAILABLE IN 5 SIZES

Write for new Catalog No. 60

Patented or Patents Pending in U. S. A. and foreign countries.

AJAX FLEXIBLE COUPLING CO. INC. WESTFIELD, N. Y.

Representatives in Principal Cities

The World's Most Complete Line of Flexible Couplings

There's safety in these numbers

UCON Brand **Hydrolube 200-N**
(Viscosity—approx. 200 S.U.S. at 100° F.)

UCON Brand **Hydrolube 300-N**
(Viscosity—approx. 300 S.U.S. at 100° F.)

UCON Brand **Hydrolube 550-N**
(Viscosity—approx. 550 S.U.S. at 100° F.)

Yes, there's safety in the three standard viscosity grades of UCON Hydrolubes—CARBIDE's safety hydraulic fluids.

Safety for men and property

● The resistance of UCON Hydrolubes to burning has been proved by years of severe, exhaustive testing in the laboratory. AND, *in actual service*, UCON Hydrolubes have prevented serious fires and injury during their more than 8 years of routine use. UCON Hydrolubes are water-base hydraulic fluids—the water content is the key to their non-flammability.

● And, for all practical hydraulic purposes, UCON Hydrolubes are non-toxic to workmen.

Safety for machines

UCON Hydrolubes...

● Have no harmful effects on packings and seals. Leakage losses are often lower than with other hydraulic fluids.

● Contain effective liquid and vapor phase corrosion inhibitors for the common metals.

● Have good lubricity. Special anti-wear agents provide satisfactory pump life and performance characteristics.

● Have high viscosity indexes—150 to 160.

● Have low pour points—can be used at sub-zero temperatures.

● And, are made in the three standard viscosity grades—others can be supplied to fit specific requirements.

For safety's sake, get all the facts. Write *today* for the booklet, "UCON Hydrolubes," Form 7380.

CARBIDE AND CARBON CHEMICALS

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A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC **New York 17, N. Y.**

"Ucon" is a registered trade-mark of Union Carbide.

BRIEFS continued

all the main difficulties have been overcome and a working vehicle put on exhibition, showing that hydrostatic transmissions are practical possibilities in the not-too-distant future. There are many advantages for such a power transmission for agricultural tractors. Layout of the tractor is greatly simplified by the elimination of the clutch, gear box, back-axle and differential gear. This transmission is practically immune from

Engine driven pump can be seen alongside the engine with the variable delivery control lever running back to the driver's left hand. Five cylinder hydraulic motor is housed inside the wheel. There are no clutch, gear box, back axle and differential.

damage resulting from overloading or inexpert handling in difficult conditions. The speed of the vehicle can, by use of a variable delivery pump, be varied from zero to maximum while in motion without jerk. The hydraulic driving motors can be housed within the wheels, which is an important feature in the construction and design of four-wheel-drive vehicles. The tractor exhibited—a prototype built for experimental and development purposes—was built on a conventional model from which the mechanical transmission was removed. J.A.L. ▼▼▼

SAE Panel Studies "O" Rings

SAE has an "O" Ring Panel which is part of the SAE Aircraft Accessories anad Equipment Division. This Panel discusses and makes recommendations for standards and specifications dealing with seals primarily for aircraft application. The panel serves to

Continued on page 36

STAYNEW

HYDRAULIC FILTERS

Save **unnecessary wear on costly pumps and other equipment by preventing intake of abrasive particles.**

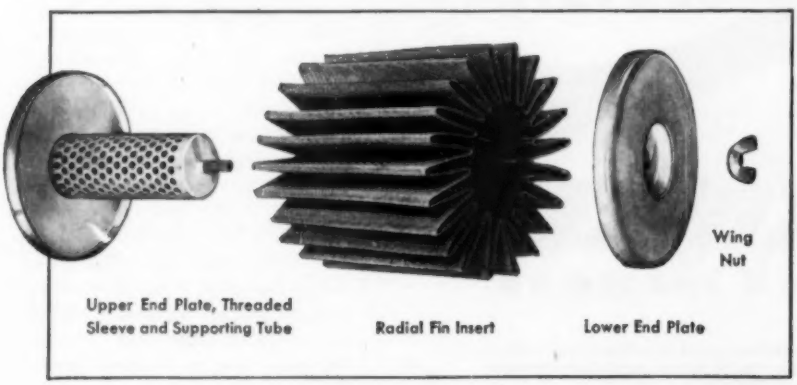
Save **spoilage and rejects at point of use by insuring clean, clear liquid.**

Save **man-hours wasted while new machines are being installed and old ones repaired.**

The Staynew HE Hydraulic Filter is a compact, simplified, efficient unit for use wherever dirty liquids are collected, filtered and re-circulated. Its unique Radial Fin design permits the largest possible filtering area in the smallest possible space—back pressure is reduced to a minimum, and long operation is assured without cleaning or replacement.

MODEL HE HYDRAULIC FILTER

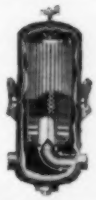
For top performance and economical operation specify Staynew Filters as original equipment on your hydraulically operated machinery.



Entire unit may be disassembled in 30 seconds merely by unscrewing wing nut at bottom and drawing out Radial Fin Insert.

Insert may be cleaned with solvent or brush in a matter of seconds

INTAKE FILTERS

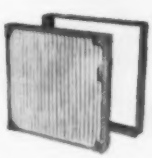


LIQUID FILTERS

PIPE LINE FILTERS

ELECTRO-STAYNEW PRECIPITATOR

AUTOMATIC AIR FILTERS



PANEL FILTERS

SPECIAL FILTERS

DOLLINGER PROTECTO-MOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Write **for Bulletin 330 which contains complete engineering data and illustrated material on Staynew Hydraulic Filters.**
Consult Dollinger engineers on any filtration problem—no obligation.
DOLLINGER CORPORATION, Dept. 65, Centre Park, Rochester 3, N. Y.

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
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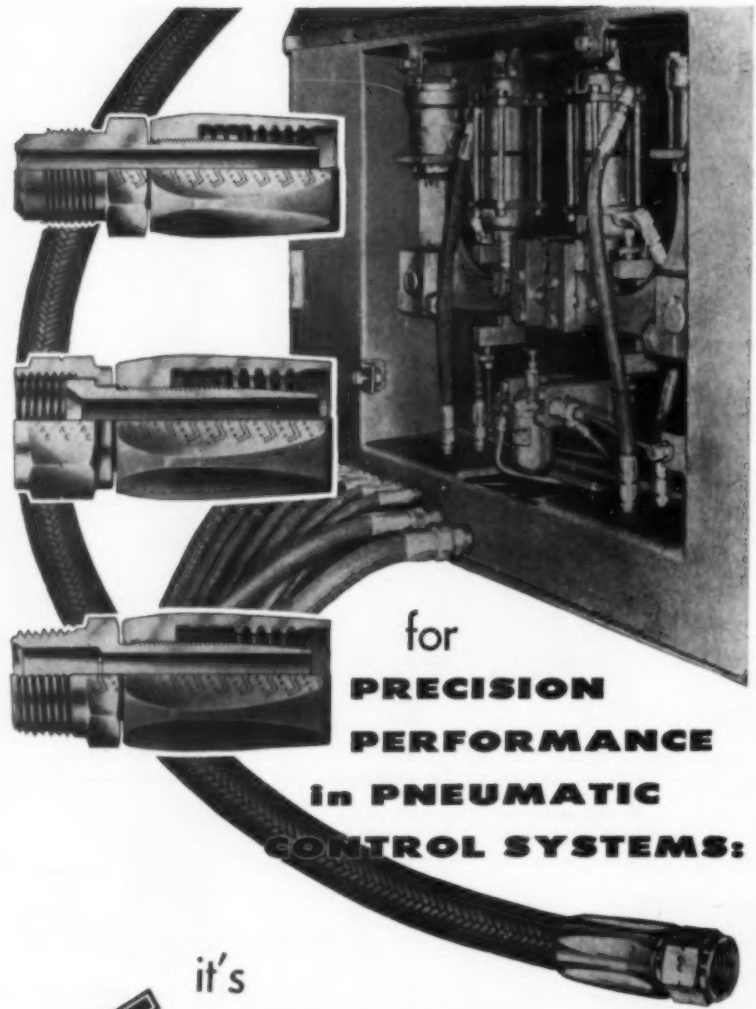
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS



for
PRECISION
PERFORMANCE
in PNEUMATIC
CONTROL SYSTEMS:

it's
STRATOFLEX
FITTINGS and HOSE

Shown above is the push button speed selector on a modern air-controlled oil well drilling rig which is equipped throughout with Stratoflex hose and fittings.

Stratoflex hose provides the flexibility, small bend radii, and durability that is essential for long service. Stratoflex fittings assure leak-proof connections under extreme pressure variations. They are quick on-and-off and are detachable and reusable.

Investigate how Stratoflex Hose Fittings can save time and cut costs for you. Ask your industrial supply dealer or write for Bulletin S-2H.

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BRIEFS / continued

coordinate efforts of various SAE aircraft committees who are concerned with seals.

Here are the results of discussions at meeting of the panel held this year:

Silicone "O" Rings: Varying shrinkages of high shrinkage silicone "O" rings present considerable difficulties in fitting to standard groove designs. A proposal, taken from an RMA project, was outlined. The proposal divides silicone packings into six basic shrinkage classifications. Copies of the Partial RMA Study on Silicone Shrinkage are available from Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 22, N. Y. This data was incorporated into an Interim Report on Silicone Shrinkage and forwarded to SAE Committee E-25.

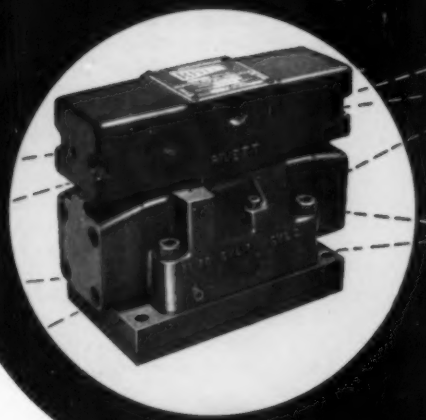
Visual inspection guide for rubber "O" rings: Members of the Panel have studied the "Visual Inspection Guide for Rubber "O" Rings (published by Bureau of Ships, Navy Department, Washington 25, D. C. as publication Number Navships 250-344-10). The Guide attempts to define aircraft quality rings or rings suitable for use in hydraulic or fuel systems, engines or any part of an aircraft, for industrial purposes and for lower quality proposes where the "O" ring is used as a rather elementary seal. The Panel determined that it was first necessary to get an acceptable definition of defects and then to establish what was an aircraft quality "O" Ring in terms of such defects. No decision was reached as to the practicality of a visual inspection.

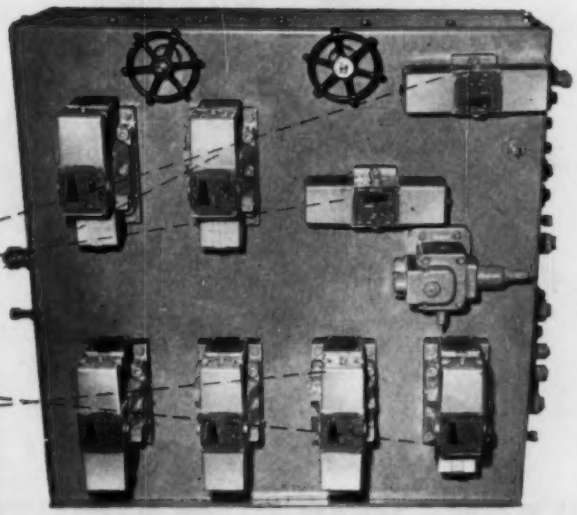
Metallic seals and metallic "O" ring seals: SAE Committee E-25, which has the responsibility of preparing standards on Metallic "O" Ring Seals and Metallic Seals, asked for assistance from the Panel in setting up a set of tabular standards for the dimensions of Metallic "O" rings. Both the assignment of E-25 and that of E-21 which will set up grôove dimensions, are dependent upon

Continued on page 38

13 cylinder circuit controlled automatically

with Rivett Panel Valves





Integrated control panel with Rivett single and double solenoid pilot-operated valves; and double solenoid pilot valves.

These features offer better automatic control

1. 3000 P.S.I. conservatively rated.
2. Meet all J.I.C. Standards.
3. Greater flow capacity (¾" rated at 28 G.P.M. at 15 ft. per sec.)
4. 7 spool designs. All interchangeable in same body.
5. Dust-sealed. Moisture-resistant cover.
6. Shock-resistant spool
7. Shock-mounted, continuous duty solenoids.

Intricate circuit of new plastic injection molding machine contains 2 injection cylinders, an ejector cylinder, gate cylinder, metering cylinder, 2 die cylinders, 2 post cylinders, 2 plate cylinders and 2 shot cylinders—hydraulically controlled by 7 Rivett Panel Mounted Solenoid Operated Valves.

The Michigan manufacturer of this unit selected Rivett Valves for their: 1—greater flow capacity; 2—low pressure drop; 3—compactness; 4—shock resistance and 5—reduced maintenance.

Increasing numbers are finding Rivett 6600 Series Valves the most practical for control of automatic operations. Working with Rivett engineers and sales representatives, these users are able to improve a machine's design, operation, life, and above all to lower its cost!

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Designed by the same engineers who developed the famous Roper Rotary Pumps, the new Roper Hydraulic Pump-Motors operate on the same principle using two equal size, smooth-running gears in a precision-fitted case. These units offer low-speed and high-torque (much needed in the hydraulic field), and their versatility finds them well-suited to heavy-duty service within their operating range. They run equally well in either direction both as pumps or motors . . . they can be direct-connected without speed reducers, thus conserving space . . . they are easily installed, easy to operate, and are long on economy. Perhaps *you* have equipment that can be further improved with a Roper Hydraulic Pump-Motor. Send for all the facts today.

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Available in foot and flange mounted models. Recommended speed range on larger sizes is from 200 to 800 RPM with pressures to 800 PSI In this range, Roper units require from 7 to 40 GPM flow and will develop up to 11.5 HP output at maximum speed and pressure. Smaller sizes may be operated up to 1200 RPM and up to 800 PSI which will require a flow of 16 GPM to develop up to 5 HP.

SEND FOR BULLETIN 22

ROPER
Rotary Pumps

GEO. D. ROPER CORPORATION • 707 Blackhawk Park Ave., Rockford, Ill.

BRIEFS / continued

the cross section of the "O" Rings.

A very detailed discussion covered manufacturing variables, materials, wall thicknesses and flange dimensions. Each available type of metallic "O" rings was described in detail. A chart has been prepared which summariezs the "O" ring types, project numbers, and the committee interested in phases of standardization of this program. The chairman has asked that each committee represented be advised by its representatives of the status of the metallic "O" ring and that suggestions on standardization and correlation of the work of Committees E-25 to be forwarded to him.

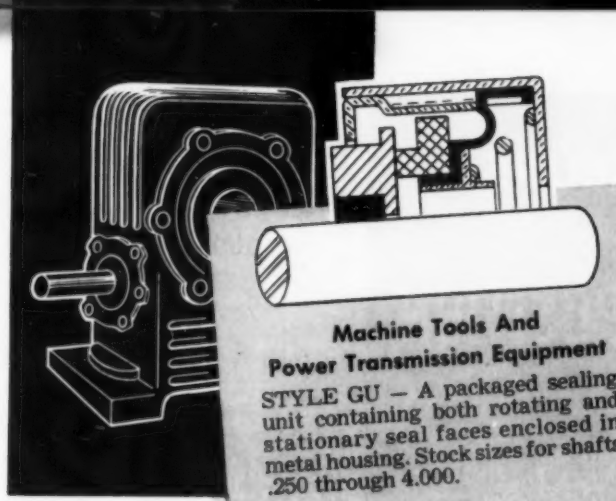
Chairman E. N. Cunningham is anxious that every supplier and major user of "O" rings be kept advised of the progress of the projects of the Panel. Attendance is nominally by invitation. Those interested are invited to write Mr. Cunningham, Precision Rubber Products Corp., Dayton, Ohio. The next meeting is scheduled for September 6 and 7, 1956 at the Van Cleve-Hotel, Dayton, Ohio.

Corrosion due to synthetic rubber: Machinery was set up for a comprehensive bibliography on corrosion due to synthetic rubbers and compounding ingredients. Assignments were made for contacts with RMA, Armed Services Technical Information Agency (A.S.T.I.A.), the Congressional Library, and American Society of Corrosion Engineers. In addition, the chairman wrote to the QPL manufacturers of both MIL-P-5516A and MIL-P-19017A "O" rings requesting their cooperation in running a neutralization number on the plasticizers used in their compounds in order to determine whether it is possible that a plasticizer which might leech out of their compound could cause corrosion. ▼▼▼

Continued on page 40

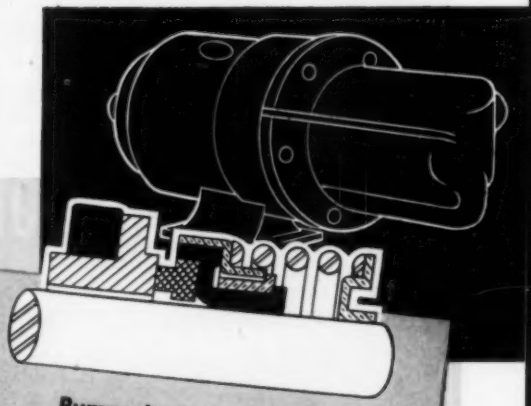
Circle 111 on Reader Service Card

Circle 55 →



Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

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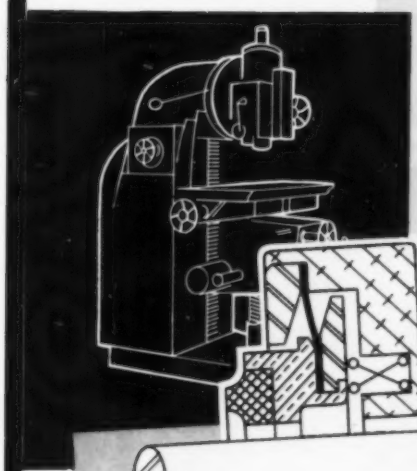

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STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

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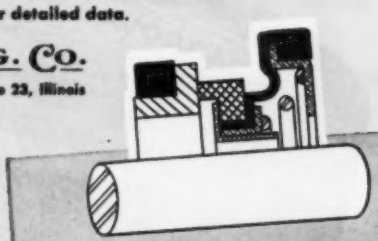
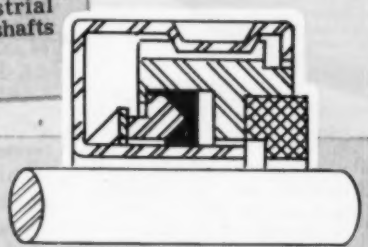


Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



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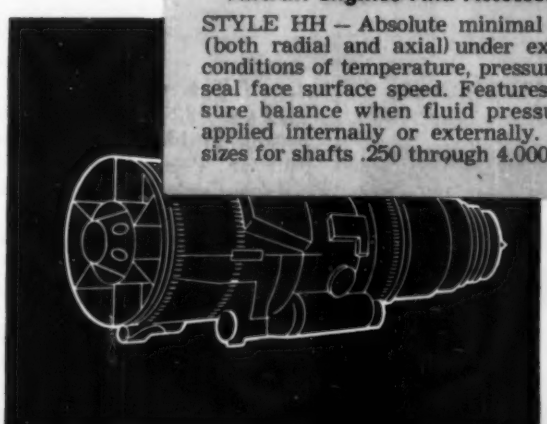

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DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

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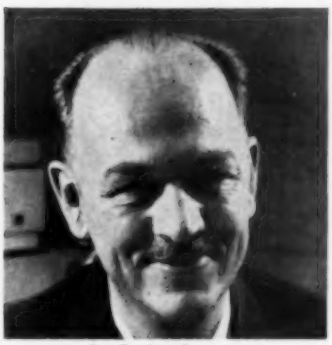
TRADE MARK PUMCUPS

BRIEFS / continued

Hydraulic Applications In Atomic Energy . . .

. . . will be prominent among the subjects at the 12th annual National Conference on Industrial Hydraulics—October 18-19, Hotel Sherman, Chicago.

The use of hydraulics in the nuclear energy field will be discussed at the opening general session under the chairmanship of Dr. Joseph C. Boyce, vice president and dean of the graduate division of Illinois Institute of Technology. Conference director of this year's conference is R. O. Isenbarger, chief engineer, Chicago Rawhide Mfg. Co., and Raymond D. Meade is conference secretary.



R. O. Isenbarger
1956 NCIH Director

The following program of ten technical sessions, devoted to discussion of the latest developments in fundamental and applied phases of industrial hydraulics, has been scheduled:

October 18, afternoon—**Pumps,** John A. Lauck, chairman; **Servo-Systems,** Ralph J. King, chairman; **Components and Accessories,** James O. Heyworth, chairman; **Pneumatics,** J. J. Slomer, chairman.

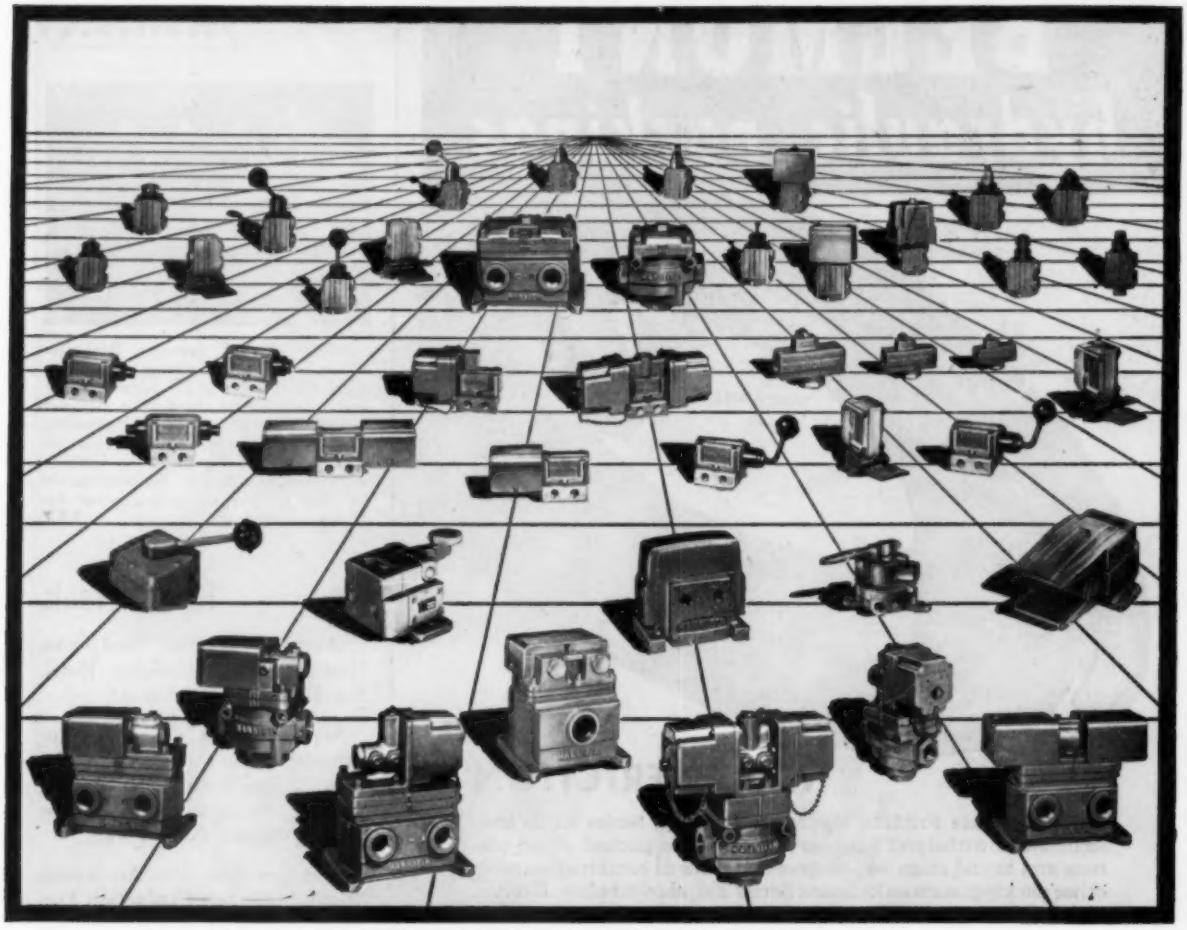
October 19, morning—**Mobile Equipment,** J. F. Ziskal, chairman; **Machine Tools,** Ernest J. Svenson, chairman; **Aircraft Systems,** J. T. Marshall, chairman.

October 19, afternoon—**Hydraulic Fluids,** R. Q. Sharpe, chairman; **Presses,** M. G. Sulser, chairman; and **Automotive,** F. L. Mackin, chairman.

An all engineers' banquet will be held on October 18. ▼▼▼

Continued on page 42

FOR AIR CYLINDER CONTROL... Manual or Electric



Hannifin is your best valve source

What air control valves do you need, or prefer? Hannifin has all types—for your production lines or the machines you manufacture. They include:

P-M Pilot-Master Valves, solenoid controlled by integral pilot heads (including new-type, dust-tight, splashproof heads that completely meet J.I.C. recommendations). ⅜" to 1¼". 2-way, 3-way and 4-way.

P-M Master Valves. ¾" to 1¼". 2-way, 3-way and 4-way, air operated. For remote control from a wide choice of P-M Pilot Valves.

P-M Direct-Operated Valves. For direct control of small air cylinders. 2-way, 3-way and 4-way. ¼" and ⅜".

Disc Valves. Rotary and sliding reciprocating disc types for hand, foot or electric operation. ⅛" to ¾".

Micrometric Speed Control Valves for micrometer-like speed adjustment through control of exhaust flow.

You can simplify your air control problems by standardizing on Hannifin.

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BELMONT
hydraulic packings

WHITE FRICTION

Belmont White Friction Hydraulic Packing, Series 10, is constructed to withstand hard service on inside packed pump pistons and as end rings on plungers and rams in combination with other packings such as Belmont Series 300, shown below. Recommended for hot or cold water and oil.

Made of fine sheeting and white friction rubber and stitched with strong linen thread. Processed to prevent excessive swelling.

Available in coils or rings with butt, bevelled or step joints.

WATERPROOF FLAX

Belmont Waterproof-Flax Hydraulic Packing, 300 series, is constructed of the best quality line flax, braided solid, treated with a waterproof lubricant, firmly formed to size and surface graphited. It is especially suitable for heavy duty hydraulic services such as accumulators, rams, presses, plunger pumps on cold water, oil, brine.

Supplied in three grades—hard, soft, very soft and in coil, spiral or rings with butt joints.

Ask your U.S. Gasket—Belmont Packing Distributor or write for Catalog No. 54.

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Butler & Sepviva Streets, Phila. 37, Pa.

U.S. GASKET • BELMONT PACKING

BRIEFS continued

Robert Einweck (extreme left), research technician in charge of the hydraulics laboratory at IIT demonstrates a new hydraulic test stand. This unit was recently donated by Greer Hydraulics, Inc., to the National Conference on Industrial Hydraulics at Illinois Institute of Technology, Chicago. The machine will be used to test valves and other hydraulic components. ▼▼▼

Future Events

August 6-8: SAE West Coast Meeting, Mark Hopkins Hotel, San Francisco, California.

September 17-21: The Instrument Society of America, the 11th Annual Instrument-Automation Conference and Exhibit. New York Coliseum, New York.

October 2-6: SAE Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display. Hotel Statler, Los Angeles, California.

October 8-12: SAE Aircraft Committees A-3, A-6 and A-6C. Hotel Biltmore, Los Angeles, California.

October 18-19: 12th National Conference on Industrial Hydraulics. Sherman Hotel, Chicago, Illinois. To register for the NCIH, write Illinois Institute of Technology, Chicago, Ill. Conference Secretary Raymond D. Meade.

October 30-November 1: 1956 Fall Meeting, National Fluid Power Association, Hotel Cleveland, Cleveland, Ohio.

November 8-9: SAE Fuels and Lubricants Meeting. The Mayo, Tulsa, Oklahoma.

November 26-30: Third International Automation Exposition. New York Trade Show Building, New York City. ▼▼▼

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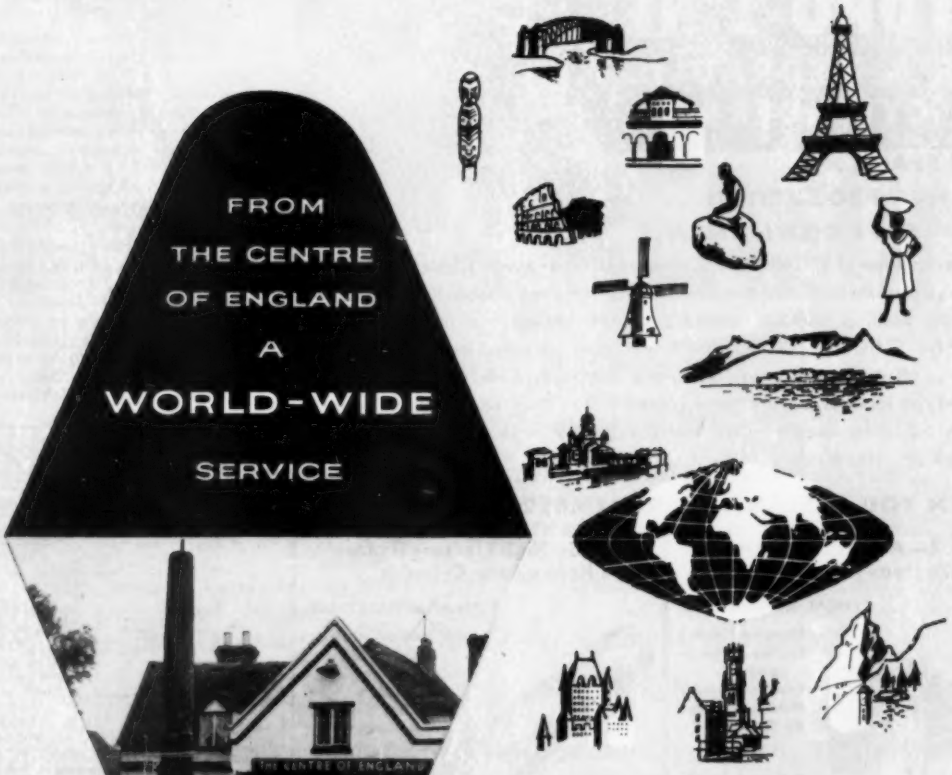

Keelavite
hydraulics

This ancient wayside cross has stood in the village of Meriden for some 500 years and by tradition marks the centre of England.

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

Just one mile from the centre of England, is manufactured the complete range of Keelavite quality hydraulics. Circuit design and equipment installation services engineer these products into Keelavite hydraulic power transmissions renowned throughout World industry for their reliability, performance and economy.

Write us for the name and address of your own Keelavite agent.

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SAVE MONEY WHILE SPENDING IT!

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AIR & HYDRAULIC CYLINDERS

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Compact design of HYDRO-LINE Cylinders with *exclusive* quick-change rod cartridge permits immediate replacement of rod seal, double lip rod wiper and rod bushing without removing or dismantling the main cylinder assembly. Other of HYDRO-LINE'S exclusive combination of features includes: all-steel end caps, one-piece piston retained by prevailing torque-type lock-nut, hard chrome plated piston rods, wrench-flats, heavy cushion adjusting needle valve interchangeable with ball check valve. Meet all JIC Standards.

WHEN YOU DESIGN . . . REMEMBER HYDRO-LINE!

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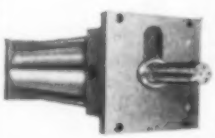
TYPICAL APPLICATIONS

Clamping Fixtures
Loading & Unloading Devices
Counter Balance
Welding Machines
Air Clutches



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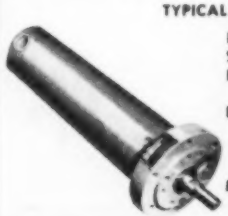
Bulletin Available at Later Date

SERIES J—High Pressure Hydraulic Extra Heavy Duty Cylinder

TYPICAL APPLICATIONS

Feed Cylinders
Slide Cylinders
Die Casting Shot Cylinders
Drilling & Tapping Machines



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Request Bulletin 53

SERIES S—Air or Low Pressure Hydraulic Extra Heavy Duty Automation Cylinder

TYPICAL APPLICATIONS

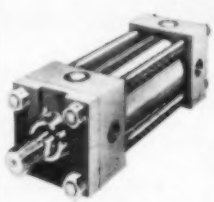
Clamping Fixtures
Welding Machines
Automation Equipment
Loading & Unloading Devices

Request Bulletin 55

SERIES N—High Pressure Hydraulic Heavy Duty Cylinder

TYPICAL APPLICATIONS

Feed Cylinders
Welding Machines
Die Casting Machines
General Machine Tools



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Representatives in all Principal Cities. Write for the name of the Hydro-Line Rep in your locality.

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Remember HYDRO-LINE when you design

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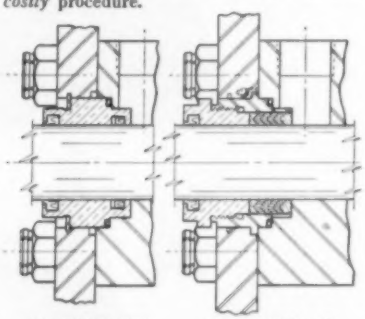
The ENGINEER'S Corner

As an engineer I am well aware of the importance of flexibility and problems brought about by continuing change which reach my department regularly. Our best answer to change is achieved through interchangeability. We are meeting this challenge by injecting flexibility in our line wherever possible.

Recently we were confronted with this problem of interchangeability on a large scale in a line of transfer machines for processing V-8 engine blocks for a large automotive manufacturer. The machines were designed by several large machine tool manufacturers to conserve all possible production space which meant that the hydraulic cylinders in a majority of the cases would not be mounted in easily accessible locations.

As a result when a severe leak showed up in a cylinder and it failed to maintain pressure the customer knew he would be faced with considerable downtime for cylinder removal and repairs. In some inaccessible locations as much as 8 to 10 hours would be involved. This would mean production stoppage of an entire shift and based on a production rate of 60 blocks per hour a *costly* procedure.



STANDARD "N" CYLINDER — with ADJUSTABLE PACKING

How Hydro-Line provides for interchangeability of Adjustable and Non-adjustable packing in Standard N Cylinders.

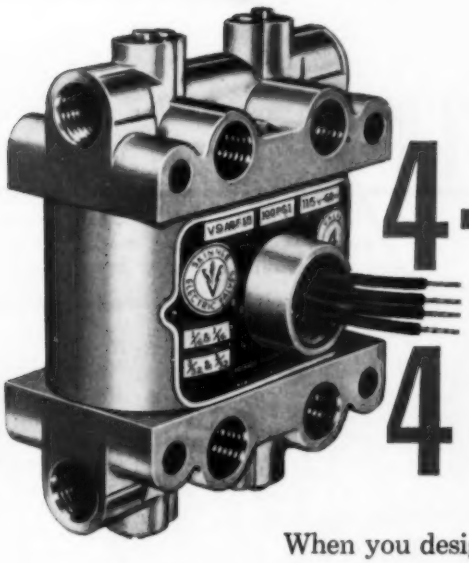
The natural solution would be a cylinder on which slow down or repair of a leak could be made until scheduled maintenance could make permanent repairs.

Along with other cylinder manufacturers we were asked to submit our solution. Our proposal was selected because it answered effectively the problem of adjustable packing and equally important because of the interchangeability provided through use of our standard N cylinder.

Our solution was to take our standard N cylinder with non-adjustable packing and equip it with a threaded gland packing retainer. By merely replacing bushings the customer could convert the cylinder from non-adjustable to adjustable packing or vice versa. It enabled the customer to take up the rod packing while the cylinder was still on the machine, stopping small leaks around the piston rod and executing temporary maintenance with complete safety until permanent maintenance could be achieved between shifts. Our standard N cylinder with non-adjustable packing and the converted N with adjustable packing were interchangeable even to end caps and follower. The problem was solved and interchangeability achieved to the complete satisfaction of the customer.

Joseph L. Bosi

Hydro-Line Manufacturing Co.
Chief Engineer



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When you design or modernize equipment, look into the four big reasons for using Skinner's low-cost V9 Solenoid Valve. 1. Only 4 5/10″ high, the V9 fits nearly anywhere, saves space, yet is powerful enough to operate single- and double-acting cylinders. 2. Available in more than 176 variations of capacities, metering and types; it can be used with air, inert gases, hydraulic oils and other common media at 0-150 p.s.i. 3. The V9 provides leakproof, dependable, *fast* operation — up to 600 cycles per minute in many applications. 4. Its rugged, frictionless construction and precision engineering ensure life spans of *millions of cycles,* eliminating replacement and maintenance problems.

For complete information, write for Catalog D2.

SKINNER SOLENOID VALVES

SKINNER ELECTRIC VALVE DIVISION • SKINNER CHUCK COMPANY

THE CREST OF QUALITY

SKINNER ELECTRIC VALVES ®

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New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

OIL FILTER
. . . with depth type element

Design: Unit consists of two parallel filters with a flanged switching valve supported between them. Each filter is equipped with a 3-way cock and differential pressure gage. Cover lifting mechanism facilitates cover removal and exchange of filter recharges. Filter cartridge is laminated fiber disk type with filtering action both through proximate disks and adjacent portions to provide maximum filtering capacity. The extended area filter has high flow rate at low pressure drop with fine filtering absorption and neutralizing properties of a depth type filter. Filter recharge is expendable. Each filter has capacity of 225 gpm of 150 SSU viscosity oil at about 5 psi pressure drop. Units may be operated independently or in parallel.

Wm. W. Nugent & Co.
Skokie, Illinois

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HOSE COUPLING
. . . for 5000 psi

Designation: Inter-Lock

Features: Positive positioning is obtained when the outside rib of the clamp is locked between the collar and hex of the insert, before tightening. Accurate location of the clamp over the insert assures alternate mating of the barbs of the insert with the circular ribs of the clamp. Hose and wire are not pinched or weakened as if barbs and ribs were directly opposite. Beveled shoulder of barbs permits easy installation of insert.

Specifications: Coupling is for low, medium, and high pressure hose to 5000 psi. Units are available for hose from ¼ to 2-inch ID. Standard inserts are male pipe, male flare and female swivel. Malleable iron clamp is furnished with heat-treated bolts.

Eastman Mfg. Co.
Manitowoc, Wisc.

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FLUID DRIVE
. . . adjustable speed

Performance: Required maintenance is limited to complete change of oil or chemical analysis once a year. Unit can be operated continuously without maintenance. Drive permits accuracy of repeated speed settings. Output shaft speed is altered during operation by varying the amount of oil in the working circuit. Working oil level is controlled by any method of automatic actuation. Drive permits motor to come up to speed under virtual no-load conditions. This allows design simplification in selection of motors and starters. Load may be de-clutched at any time.

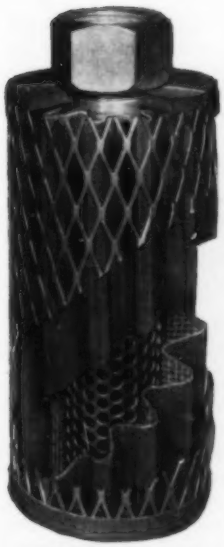
Features: Reversible drive is available for applications of 1 to 25 hp. Output connection may be direct, belt, or chain. Unit has no wearing parts in the working circuit, and power transmission is accomplished hydraulically by impeller on input shaft and runner on output shaft.

American Blower Corp.
Detroit, Michigan

Circle 157 on Reader Service Card

Continued on page 48

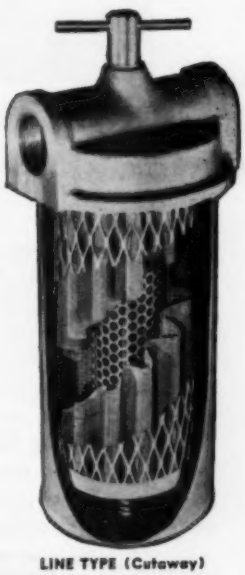
Simplify Your Preventive Maintenance



SUMP TYPE (Cutaway)

with

MARVEL SYNCLINAL FILTERS



LINE TYPE (Cutaway)

For All Hydraulic and Other Low Pressure Liquid Systems

SIMPLE, EFFICIENT DESIGN
REDUCES DEMAND ON YOUR SKILLED MAINTENANCE HELP

ANY WORKMAN can disassemble, clean and reassemble Marvel Synclinal Filters. Cleaning is done quickly, and Marvel's extra capacity requires less frequent cleanings. This means more production per machine with less man hours. Marvel protected machines spend their time producing, not in being serviced and repaired. Marvel's BALANCED Synclinal Design and simple efficiency changes down-time to producing time.

STANDARDIZE WITH MARVELS
Choice Of OVER 650 Original Equipment Manufacturers

Improve your all-important preventive maintenance by simplifying it. Use Marvel Synclinal Filters throughout your plant. Specify Marvel on new machines, add Marvel to present machines. No moving parts to wear, nothing to keep in stock. Your first cost is your only cost.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer IMMEDIATE DELIVERY.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.
7227 N. HAMLIN AVE., CHICAGO 45, ILL.
PHONE: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters as indicated.

☐ Catalog #107 for Hydraulic Oils, Coolants, Lubricants AH-7
☐ Catalog #301 for Water
Data on Filters for Fire-resistant fluids ☐ AQUEOUS ☐ SYNTHETIC

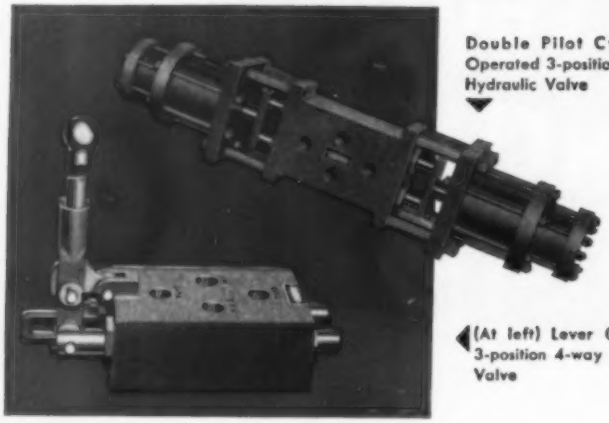
Name _____ Title _____

Company _____

Address _____

City _____ State _____

Quick-As-Wink® Hydraulic Valves



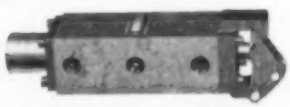
Double Pilot Cylinder Operated 3-position 4-way Hydraulic Valve

(At left) Lever Operated 3-position 4-way Hydraulic Valve

Hand and Pilot-operated Types for water or hydraulic oils to 5000 psi.

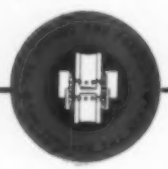
• These valves give users maximum efficiency, economy and dependability. Housings are milled from steel blocks or bronze forgings. The hollow, radially ported, stainless steel plungers are hard chrome plated and polished. Renewable metal valving rings assure long life of the packers which are expanded by internal pressure . . . the higher the pressure the tighter the seal. No metal to metal seating. The valves are fully balanced in any position. Inspection — and servicing if necessary — can be done easily *in the field*, avoiding the delays of returning valves to the factory for servicing, or the need to carry large inventories of standby valves — or even parts. Complete dimensions, capacities and other data sent promptly. Write for Bulletin No. 531,— Today!

Ask us also about . . .



CAM OPERATED SINGLE PLUNGER VALVE 3/8" to 3/4" sizes. Operated by rotating cam or land on reciprocating device.

DOUBLE SOLENOID "O-TYPE" VALVE for pressures up to 125 psi. Widely used as pilot valves and for operating air cylinders.



Quick-As-Wink® AIR AND HYDRAULIC Control Valves

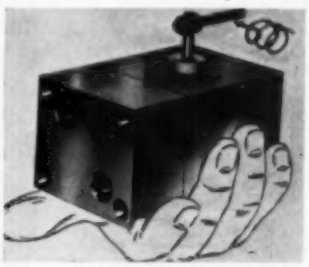
Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1991 East Pershing St., Salem, Ohio

New Products continued

HYDRAULIC RELAY . . . requires low force

Features: Unit is capable of high frequency response and may be installed in any position. Rugged, compact unit may be operated at hydraulic pressures to 750 psi without the use of auxiliary devices.



Any sensing device that produces a signal force in the magnitude of a few grams can actuate the hydraulic relay which controls a greatly ampilfied fluid power force. The relay is available as a component, or it can be furnished with complete signal system, pump unit, and accessories for specific control applications such as web guide, speed, pressure, flow, etc.

Hague Regulator Corp.
Orangeville, Ohio

Circle 158 on Reader Service Card

VARIABLE SPEED DRIVE . . . 1 to 10,000 rpm

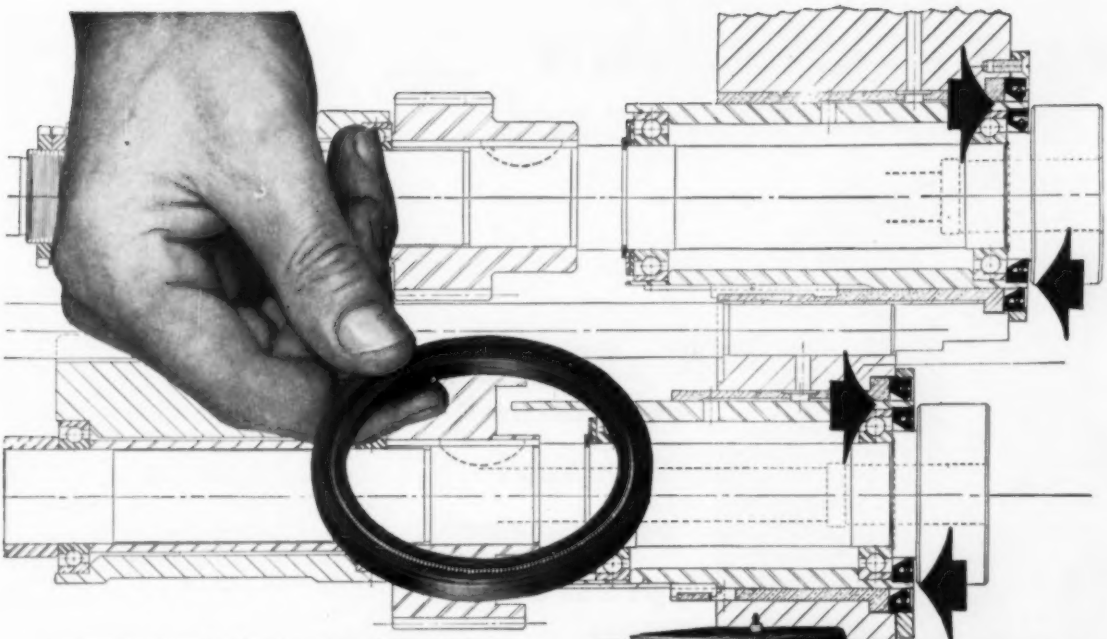
Designation: U. S. Varidyne

Features: System consists of a central power unit which interlocks several motors by means of electrical impulses. Turning the control

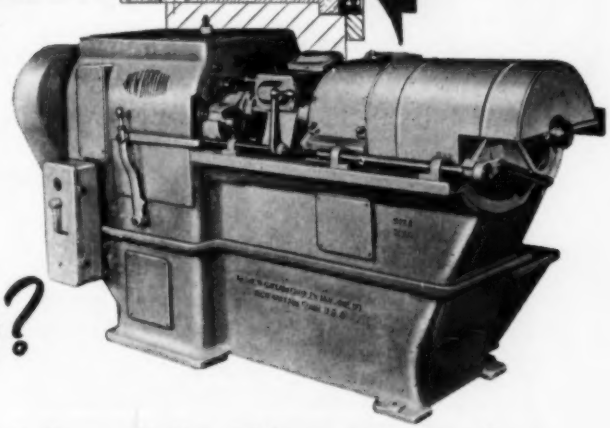
dial on the power unit varies the speed of each motor equally and simultaneously. Motors are squirrel cage type.

Specifications: Enclosures are available in drip-proof, totally-enclosed, and explosion-proof designs. Speeds from 1 to 10,000 rpm are available in ratios up to 5:1 and higher speed ratios can be supplied. Motors are 1/3 to 25 hp and power

Continued on page 50



Blueprint shows four locations where Clipper Seals help maintain smooth running, accurate operation of the New Britain Model 23A Chucking Machine. Photograph is of the complete machine.



Is this your OIL SEAL problem?

New Britain solved it with Clipper Seals

WHEN the New Britain Machine Company, New Britain, Conn., designed their model 23A Automatic Chucking Machine, they were planning a machine tool that would maintain its precision under long, hard service conditions.

This called for tough, precision-made components—of which Clipper Seals are an outstanding example. The compact design of these seals and their ability to do a highly efficient job of retaining lubricants, and sealing against cutting oils and abrasives, were important factors in New Britain's choice of Clipper Seals.

Clipper Seals won out on other counts, too. It was found that they decidedly reduce friction and wear, assuring trouble-free operation and long service life at high shaft speeds. In addition, Clipper Seals supplied the answer to easy installation because the tough, dense heel provides just the right amount of rigidity for a press fit in the cavity . . . while the flexible lip, held in light but positive contact with the shaft by an especially designed garter spring, provides effective sealing at all times.

These precision-moulded oil seals—made in both split and endless types—are available in a wide variety of designs, and in heel and lip compositions to meet practically any sealing requirement. For details, write for Brochure PK-46A. Address Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville CLIPPER SEALS

YES--CLOSER CONTROL

now consistent control of system pressure for exacting needs

Wherever consistently close pressure control is needed, H-P-M's complete line of system-proved valves will give you the sure-fire answer. Smooth, balanced operation, close differential between opening and closing pressures, rugged construction, maximum service life add up to H-P-M for assured better control. H-P-M's line is designed for every circuit requirement . . . relief, sequence, unloading, pressure reducing, counterbalance valves available with threaded, flanged or gasket connections. Size ¼" to 2½" for 2000 and 3000 P.S.I. service. Your nearby H-P-M representative has all the facts—call him today, or write for complete information. Other H-P-M quality products include a complete line of radial and gear pumps, cylinders, standard and special power units.

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

HPM

NFPA NATIONAL FLUID POWER ASSOCIATION

New Products / continued

units can carry from 1 to 50 hp connected load.

Application: System is particularly valuable when motors are operating in tandem on a conveyor. They will share load equally and eliminate overloads at any one point. System is also used when two conveyors must be coordinated where parts are converging for assembly.

U.S. Electrical Motors Inc.
Los Angeles, California
Circle 159 on Reader Service Card

CUT-OFF MACHINE
. . . for rod, bar, tubing

Features: Machine can be used with a dry-cutting abrasive wheel, high-speed saw blade, or conventional wood-cutting blade. Precision-made machine cuts true and

clean eliminating many finishing operations. Cut-off machine can be equipped with air feed attachment for production runs. Attachment can be used with automatic stock feed or manual feed. Automatic spray coolant system to supply coolant to the blade is also available. Machine takes abrasive wheels and saw blades to 12-inch diameter. 3-hp motor is supplied with the machine.

Walker Turner, Inc.
Plainfield, N. J.
Circle 160 on Reader Service Card

AIRCRAFT OIL MOTOR
. . . with anti-overrun control

Features: Constant speed motor has integral flow control to prevent uncontrolled runaway or overspeeding. Both inlet and return oil is metered, so that motor overloading is also avoided. Flow control provides constant speed drive in either

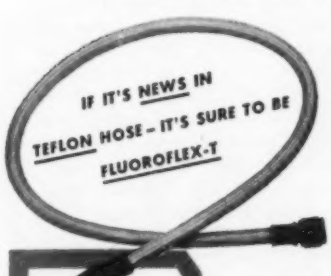
Continued on page 52

New plant now filling big demand for Teflon® hose

...the finest hose yet for tough service

MODERN, enlarged facilities of this newly opened Resistoflex plant are now producing record quantities of Fluoroflex®-T hose . . . the finest quality hose ever developed for vital applications.

It has a tube which is specially compounded and extruded from Teflon by Resistoflex. This tube is not only completely inert to all hydraulic fluids, but also applicable for ambient temperatures from –100°F to 500°F. SAE 304 stainless steel wire braid reinforces to 1000 psi working pressure . . . to 3000 psi in –4 and –6 sizes. Non aging, the hose stays flexible indefinitely. Its leakproof, permanently swaged fittings are also blowoff-proof.



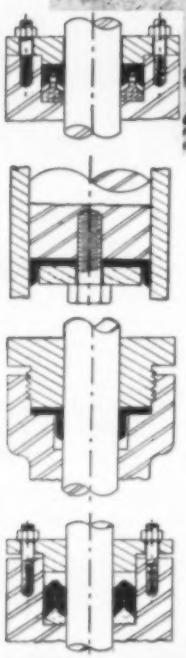
Fluoroflex-T hose is the *original* Teflon hose . . . the only one proved by over 3 years' service experience. Bulletin FH-2 tells more. Send for it.

RESISTOFLEX CORPORATION, Roseland, New Jersey; Western Plant: Burbank, Calif.

®*Teflon is a DuPont trademark; Fluoroflex is a Resistoflex trademark.*

20th year of service to industry

Resistoflex



. . and you can't beat Tannate Leather Packings for their inherent tendency to hone or "lap" in the metal parts upon which they work. Other packing materials operating under the same conditions have a tendency to score, yet Tannate Packings will not score or abrade the most highly finished surfaces.

Tannate Packings are precision molded and accurately finished for a most effective leak-proof seal. Tannate packings are job engineered from start to finish to meet your exact requirements.

If you design or maintain cylinders or presses send for Rhoads new Packing Hand Book now. Write J. E. RHOADS & SONS, 2100 W. 11th St., Wilmington 99, Del.

RHOADS
INDUSTRIAL LEATHERS

Wilmington New York Chicago Atlanta

New Products / continued

direction and forward and reverse speeds are individually set.

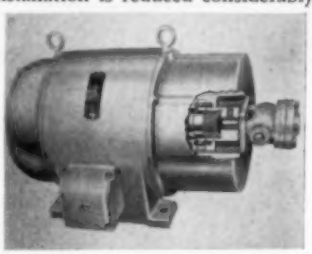
Design: Motor consists of valve plate, speed regulator valve, and flow control combined with piston

type motor. Motors can be furnished for 150 ft-lb torque (86 hp) at pressures to 3000 psi. Smaller motors operate at 7200 rpm with intermittent speeds to 9100 rpm. Volumetric efficiency of the motor is approximately 96%.

Vickers, Inc.
Detroit, Mich.
Circle 161 on Reader Service Card

SPLINE COUPLING . . . for hydraulic pump

Features: Spline coupling method of mounting pump on electric motor eliminates all adapter and alignment problems. Time for pump installation is reduced considerably.



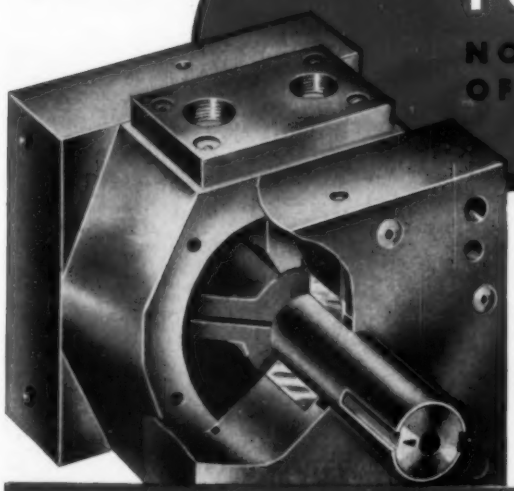
Spline coupling is supplied with motor and accommodates all standard make pumps. Installation achieves streamline appearance and compactness with the new 30-hp unit being 2½ inches shorter than the previous 15-hp unit. Pump motors are available in ratings from 15 hp through 40 hp in frame sizes 324U and 326U for either single or double-end pump installations.

Reuland Electric Co.
Alhambra, Calif.
Circle 162 on Reader Service Card

For more NEW PRODUCT reviews turn to page 130

New ROTO-MATION TORQUE MOTOR

NOW OFFERS 4 COST-CUTTING ADVANTAGES



For Oil or other Pressure Mediums.
Pressure Against Vane Reciprocates Shaft.

TYPICAL TORQUE RATINGS (IN.-LBS.)
Single Vane Units—280° Arc both directions

BORE SIZE	Vane Length	100 PSI	500 PSI	1000 PSI	WT. LBS.
3"	2"	150	750	1500	15
	4"	300	1500	3000	21.5
	6"	450	2250	4500	28
6"	3"	1000	5000	10,000	92
	6"	2000	10,000	20,000	104
10"	5"	5000	25,000	50,000	286
	8"	8000	40,000	80,000	312
	12"	12,000	60,000	120,000	387
20"	6"	30,000	150,000	300,000	1620
	12"	60,000	300,000	600,000	2100

NOTE: Double Vane Units double torque with same pressures, but rotation is limited to 100° in both directions.

✓ **HIGHER TORQUE OUTPUT**—special neoprene and teflon vane seals minimize leakage . . . insure greater power. Speeds limited only by fluid pressure volume. Full torque power obtainable in fraction of a second.

✓ **GREATER OPERATING EFFICIENCY**—through superior design of special vane seals and close tolerance fitting of all parts. Operates at 95 to 98% efficiency, withstands heat up to 200°F. Special models and seals for higher temperatures.

✓ **SIMPLE, ECONOMICAL APPLICATION**—eliminates complex linkages, sprockets, chains, cylinders. Saves space. Applicable to turning, opening, closing, clamping, indexing, feeding, pushing, or moving any type of load or mechanism.

✓ **LONGER SERVICE LIFE**—fewer moving parts, precision machined components, bronze nut and thrust bearings, chrome vanadium and chrome-moly steel shafts. No external leakage.

COMPACT, RUGGED, ADAPTABLE TO A WIDER RANGE OF APPLICATIONS

The new ROTO-MATION Oscillating Torque Motor is a simple, more versatile hydraulic-pneumatic device especially designed to produce more torque power (1,800,000 in.-lbs. from 20" bore) to serve a wider variety of automation applications. Compact and rugged, the new motor is easily adaptable to original equipment or as a replacement unit. Wide ports and flange-type connections meet J.I.C. standards. Extensive tests prove that performance life is many times greater than any device previously manufactured. The square shape facilitates easy mounting on any of six faces. There are 14 mounting models available and four shaft styles. Units are complete with standardized controls, fittings, and auxiliary devices. Sizes are available for moving loads ranging from a few ounces to many tons.

Write **FOR COMPLETE SPECIFICATIONS**—New catalog provides complete specifications, illustrates and describes wide variety of applications, and contains complete torque load graphs.

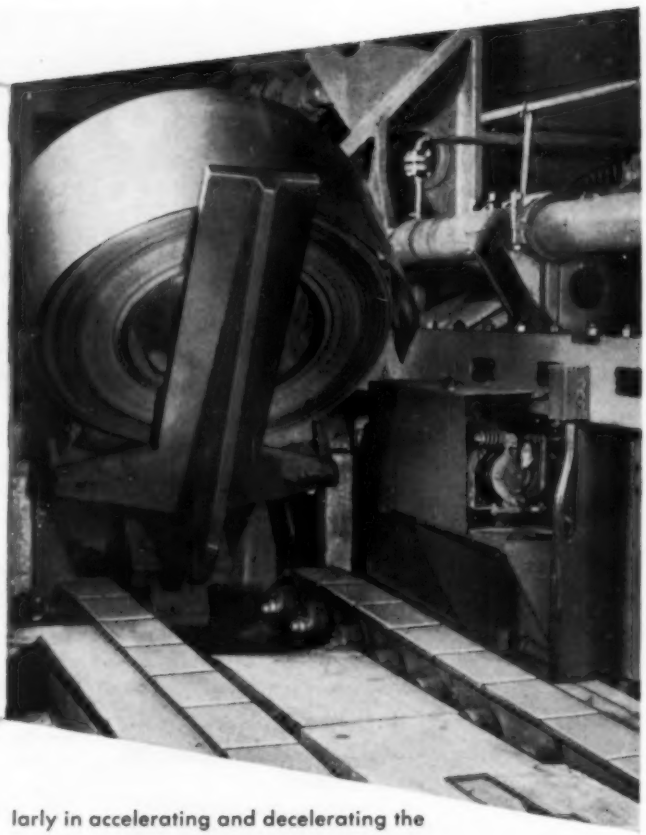
ROTO-MATION INC.

NOW A SUBSIDIARY OF PINES ENGINEERING CO., INC.

943 E. SATER STREET • GREENVILLE, OHIO

MANUFACTURERS OF ROTO-MATION MOTORS, CONTROLS, AND AUXILIARY TRANSMISSION EQUIPMENT

This is a DOWNENDER

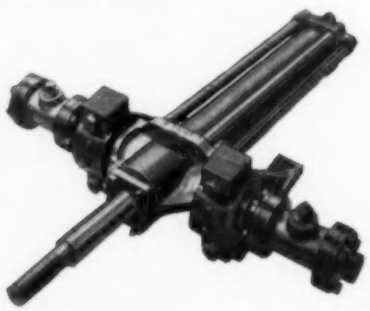


It takes a coil of steel strip weighing 20,000 pounds or more, and lays it over on its side for removal on a conveyor.

The particular Downender pictured is hydraulically operated and the control circuit for it presents some tricky problems. These stem largely from the fact that as the coil is "downended," there is a point in the travel where the load shifts from a resisting one to one which tends to "override" or "run away."

These problems have been solved, of course, but generally using the conventional methods and components. The results, performance-wise, have not always been entirely satisfactory.

An entirely new approach to these problems was evolved. Our own solution has resulted in a hydraulic system of surprising simplicity. What is more, we are able to provide higher speeds with greater smoothness of motion — particularly in accelerating and decelerating the coil—than had previously been thought possible. Performance is further enhanced, and maintenance reduced, by virtue of our trunnion type cylinder which permits rigid installation of piping, eliminating hoses.

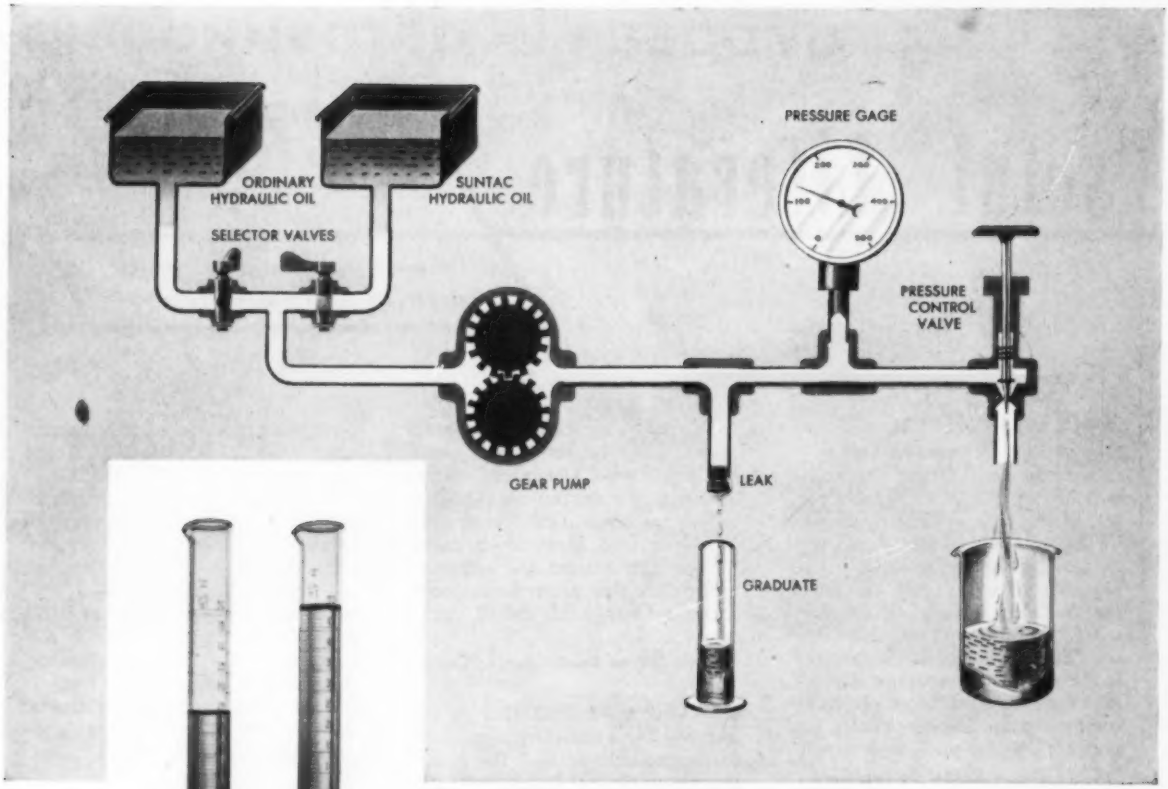


TRUNNION TYPE CYLINDER

Here, then is another example of LASSMAN engineering design and equipment which is your guarantee of improved performance. We would appreciate the opportunity of quoting on your requirements.

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.



The leak rate of ordinary oil vs. Suntac was measured in test machine simulating a typical leak in a hydraulic system. Oil viscosities were equal, time and pressure conditions identical. The simple act of switching from the ordinary oil to Suntac, *without any other changes*, reduced oil leakage by 50%.

PRESSURE SYSTEM DESIGNED TO LEAK PROVES SUNTAC CUTS OIL LOSSES UP TO 50%

If you're having troubles with excessive oil leakage, a Suntac® oil can help you. Because of their unusual anti-leak characteristics, Suntac oils reduce oil consumption up to 90%, users report.

Suntac oils will not gum up or otherwise harm circulating systems. These oils are high-quality petroleum products with a life expectancy longer than that of ordinary hydraulic and circulating oils.

A change to a Suntac oil can lower your oil costs... improve housekeeping... result in safer working conditions.

Your Sun representative can tell you more about Suntac oils. Or write for Technical Bulletin 23. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. **AH-7.**

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY Philadelphia 3, Pa.

©SUN OIL CO.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

INDUSTRIAL FILTERS . . . how they can lower production costs is the theme of Bulletin 651 from R. P. Adams Co., Inc. Various water filters are pictured and outlined, and typical installation arrangements shown. Colored drawings illustrate the cycle of operation including precoating, cleaning with compressed air, and backwashing. Also indicated in the bulletin is the company's separator for removing condensate and oil from compressed air. An aftercooler for pressures to 900 psi is also shown.

Circle 200 on Reader Service Card

SOLENOID AIR VALVES . . . which are self-cleaning and have a self-lapping floating seal are featured in Catalog 101 offered by Valcor Engineering Corp. Dimensions and performance data are given fo reach valve model and tables indicate prcies and optional features which are available. The floating seal is self-cleaning, and the valve seats are wiped clean with every stroke to prevent clogging. Optional features include metering and purging control for fast bleeding of air from lines.

Circle 201 on Reader Service Card

PACKINGS . . . of leather and synthetic rubber is the subject of an educational, 60-page publication, designated Catalog and Manual 201B by Graton & Knight—International Packings Co. The manual contains engineering discussions and drawings on such subjects as Standardization; Types of Mechanical Packings; and Application of Cup, Flange, U, and V Packings. The section on leather packings gives information on the importance of leather as a packing material and explains leather treatments. Standard dimensional data is given for cup, flange, U, and V leather packings. The section on synthetic rubber packings outlines general properties and outstanding characteristics of natural and synthetic rubbers. It also gives dimensional data for O-irngs, U, and V packings.

Circle 202 on Reader Service Card

DRILLED MANIFOLDS . . . are illustrated in a leaflet distributed by Birmingham Hydraulic. The literature shows several installations and lists the advantages of manifolds. These include minimum leakage, better appearance and easy valve servicing.

Circle 203 on Reader Service Card

PNEUMATIC DISCONNECT . . . which instantaneously converts any pneumatic connection into a straight-through line with pressure drop equivalent to that of a straight, smooth tubing section is specified in a data sheet released by Eastern Aircraft Products Corp. The data sheet outlines the construction of the unit and describes the principles of operation. The design features are listed and explained, and graphs for two models are included to show the performance of the connector in terms of pressure drop plotted against scfm/inlet pressure.

Circle 204 on Reader Service Card

CONTROLLED AIR POWER . . . Bulletin ML-3R produced by The Belows Co. illustrates many applications of air power suggesting the many ways in which this can provide lower cost production. The linear air motor, air-oil cylinder combinations, solenoid and manual valves, tool feeds, and index tables are described generally to indicate outstanding features. The air motor permits a choice of five basic types of built-in, 4-way valves and bores for thrusts of 1, 2, 10, or 15 times the applied air pressure. The one air connection required can be made with flexible hose. The units are available in a variety of mounting styles with standard strokes from 1 inch to 18 inches and special strokes to 48 inches.

Circle 205 on Reader Service Card

HYDRAULIC HOSE . . . is the subject of a brochure issued by Thermoid Co. Specifications and constructional features are given for high pressure hose in sizes from 3/16 to 2 in.ID, medium pressure hose in sizes from ¼ to 1¼ in.ID, and low pressure hose in sizes from 3/16 to ¾ in.ID. Also specified is a return line hose which is available in sizes from ¾ to 1½ in.ID. Data for the hose includes the OD, number of braids, length change at working pressure, working pressure, burst pressure, and weight.

Circle 206 on Reader Service Card

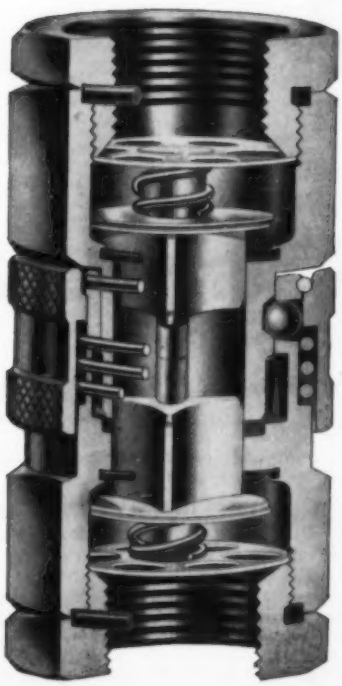
ELECTRIC MOTORS . . . A technical data sheet with dimensions and reference drawings for motors manufactured by ACEC Electric Corp. is designated as Section 242 Page D-3. The sheet presents dimensions for NEMA rerated motors from 1 through 30 hp, frame sizes 182 through 326. The new motors, which apply recent progress in insulation and lamination materials to reduce motor size without sacrificing power, afford space savings to 46%.

Circle 207 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 142

DISCONNECTED IN 1 SECOND

and NO DANGEROUS SPRAY



INSTALL SNAP-TITE "H" COUPLINGS:

- Snap-Tite "H" Series couplings are constructed so that the valve is completely closed in coupler before disengaging the nipple seal, eliminating fluid spray, and the only loss of fluid is the few drops in the nipple cavity.
- Powerful springs keep valves shut tight when "H" couplings are disconnected.

Check your couplings. Are they creating accident hazards and losing costly fluids? Are offensive odors and flammable gases escaping from them?

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—these combine to allow maximum flow capacity with lowest pressure drop.

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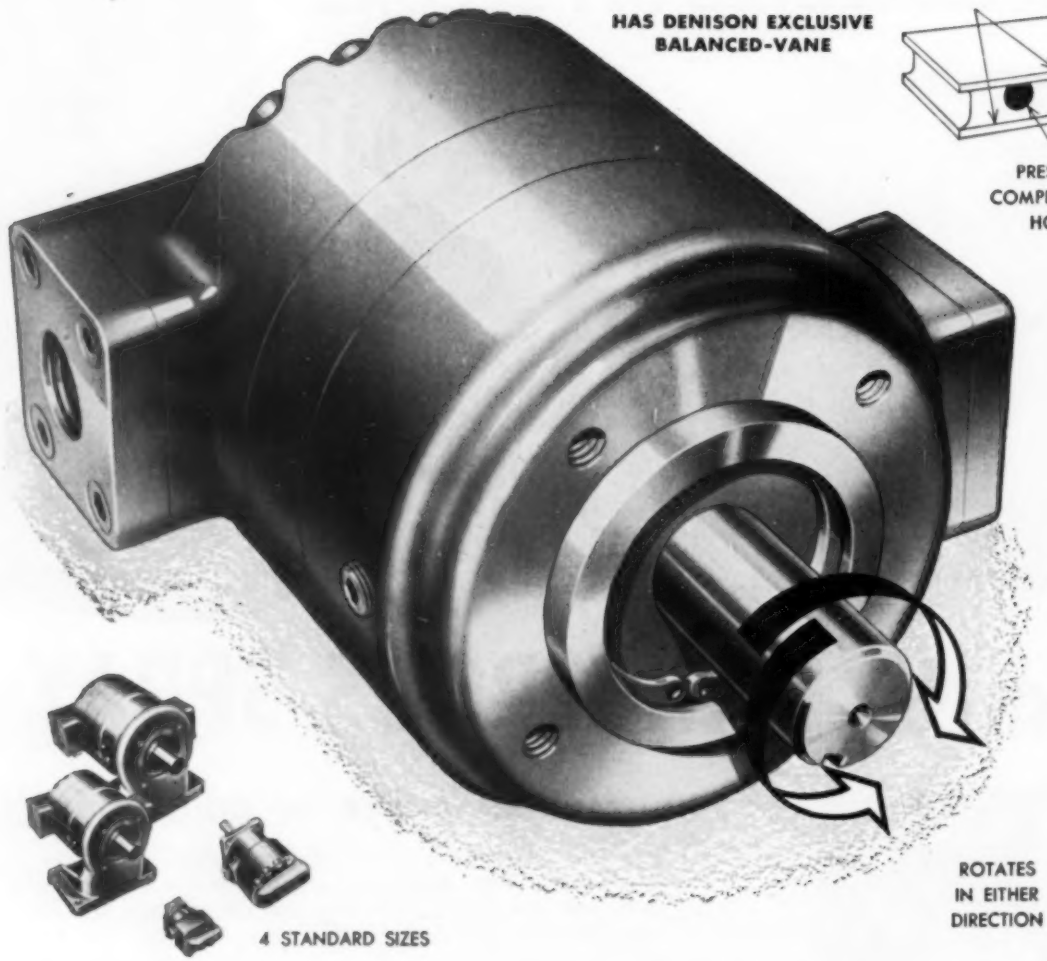

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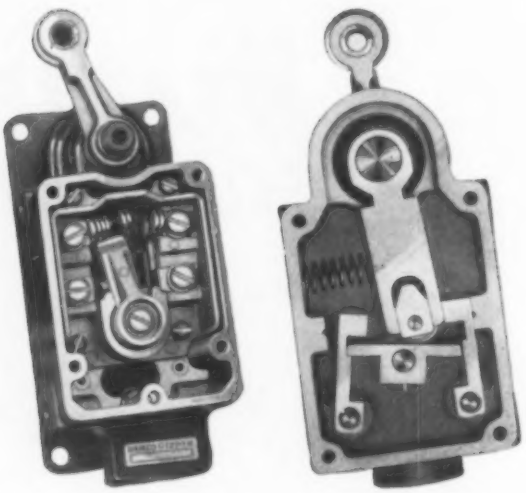

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FLUID POWER *Pioneers*

Rockford Machine Tool Co. Rockford, Illinois

STANLEY A. BJORKLUND

EARLE W. JOHNSON

YOU would be hard pressed to find a stronger supporter of fluid power for machine tools than the Rockford Machine Tool Company. Back in 1929, they took advantage of hydraulics to give independent control for fast return and to give a simple means of varying cutting speed. These features were not attainable on mechanical shaper-planers. This switch to hydraulics resulted in an increased volume of orders. Since 1929, Rockford has concentrated on producing hydraulically powered tools in which machining is accomplished by reciprocating the work-piece or the cutting tool.

Rockford's H. B. Newton, who has been its president since 1934, was the man who pioneered the company's fluid powered designs. Today, the job of designing oil powered machines to meet higher and higher power demands and to meet greater needs for automatic control is carried on by Earle Johnson who heads development and research and Stan Bjorklund who is chief hydraulic engineer.

Both Stan and Earle have grown with hydraulics at Rockford. Stan joined the company right out of Rockford High in 1930. Earle got a job with the company in 1937 when Rockford's first slotters were being developed.

We asked where they've been and where they're going with hydraulics? Earle said, "We've seen acceptance of oil power for machine tools become widespread. Although a great amount of education in the care and use of hydraulics is a continuous requirement, we're over the hurdle of acceptance. We've seen the hydraulic component manufacturers grow and develop complete lines to help meet the machine tool builders' requirements.

"Today, we're just scratching the surface of the application possibilities and designs of tools which combine hydraulic muscles with electrical and electronic controls. Feedback systems using tape and punch cards are an important part of machine tool development programs. We are always working on systems which will provide accurate, simple, safe control of machine feeds."

"In 1938, Rockford", Stan points out, "was one of the first companies to introduce a hydraulic tracer which could be used as a standard attachment on a planer. Work is going on continuously in our development setups to improve response and stability of tracer valves to meet new production demands.

"On many designs today, we are using welded fittings and straight threads with O-ring seals. Tapered pipe threads on oil hydraulic machines may soon be a trouble spot of the past."

• Fluid Power Pioneers . . . are selected by the editors of APPLIED HYDRAULICS to acknowledge the outstanding contributions they have made in the use of fluid power to improve their company's products.

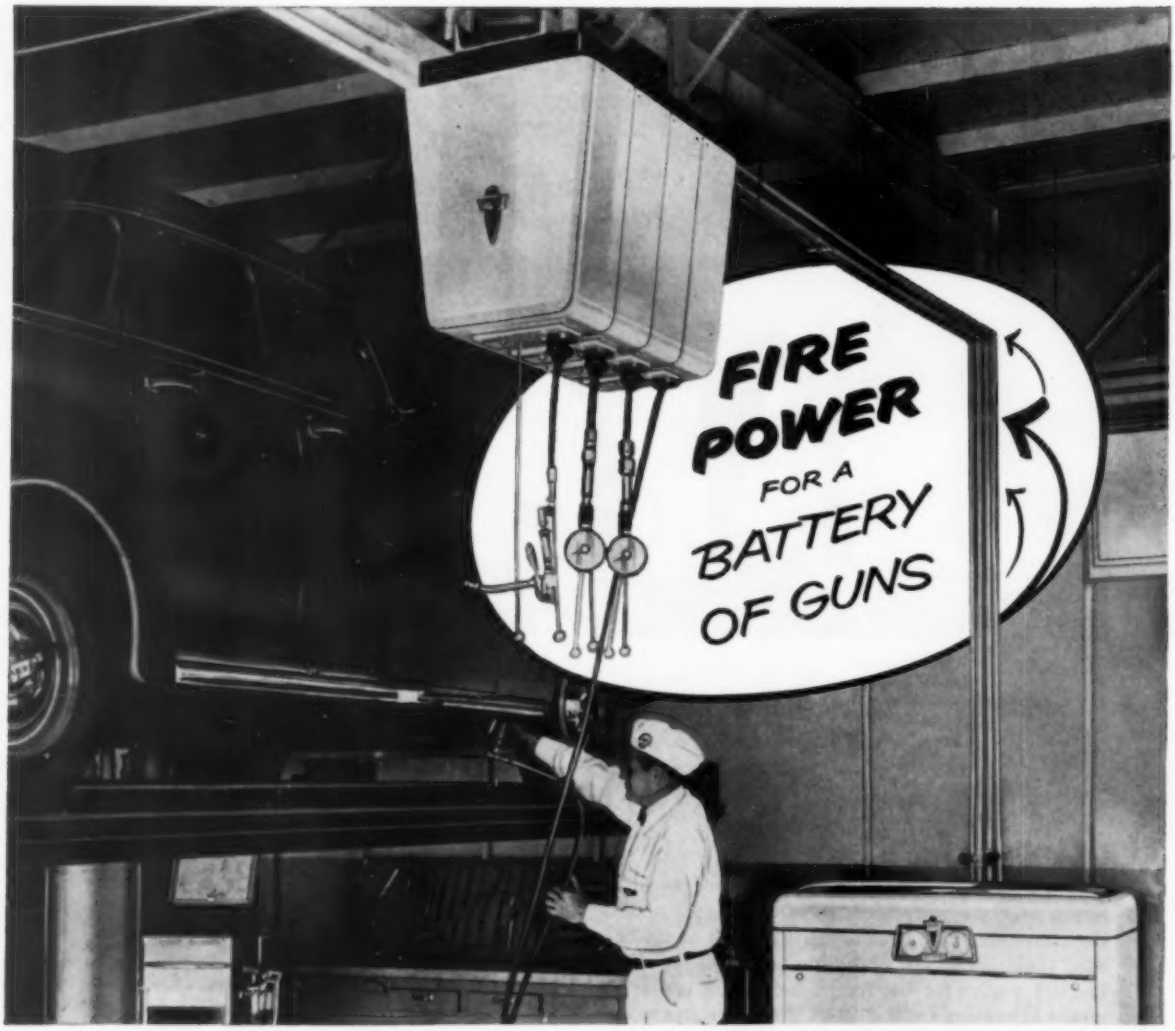

Photo courtesy Lincoln Engineering Co., St. Louis, Mo.

. . . fed under pressure through hydraulic lines of Superior tubing

When he hits the trigger of his grease gun, the mechanic wants pressure waiting there . . . ready to go to work at the touch of a finger. The ammunition for these ceiling-mounted grease guns, called Lubreels, flows through life-lines of ⅜ in. OD x .083 in. wall Superior low carbon steel hydraulic tubing . . . at pressures up to 3500 psi.

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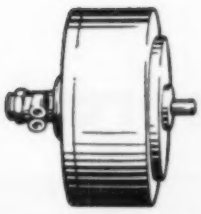
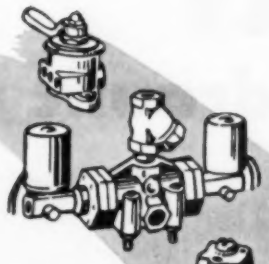
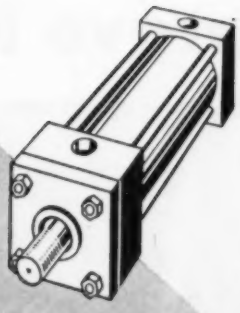


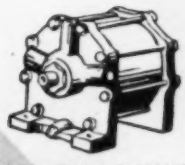
ROTATING AIR CYLINDERS



HYDRAULIC AND AIR VALVES



LOGANSQUARE AIR CYLINDERS



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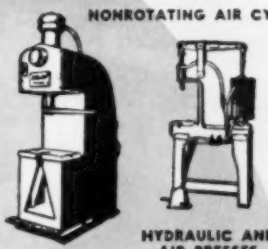
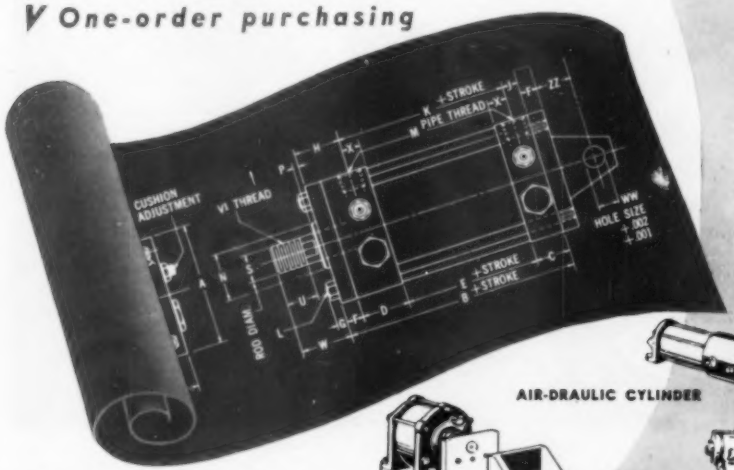
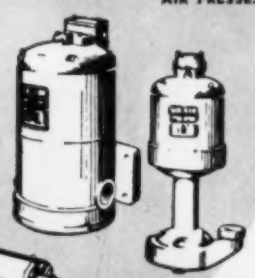


HYDRAULIC AND AIR PRESSES





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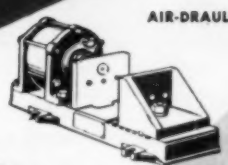
AIR-DRAULIC CYLINDER

ROTOCAST HYDRAULIC CYLINDERS



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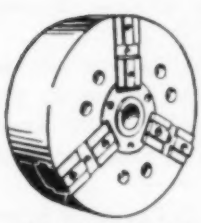
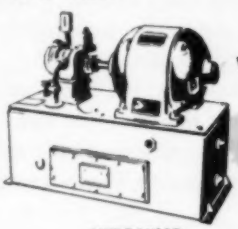


AIR AND HYDRAULIC OPERATED CHUCKS



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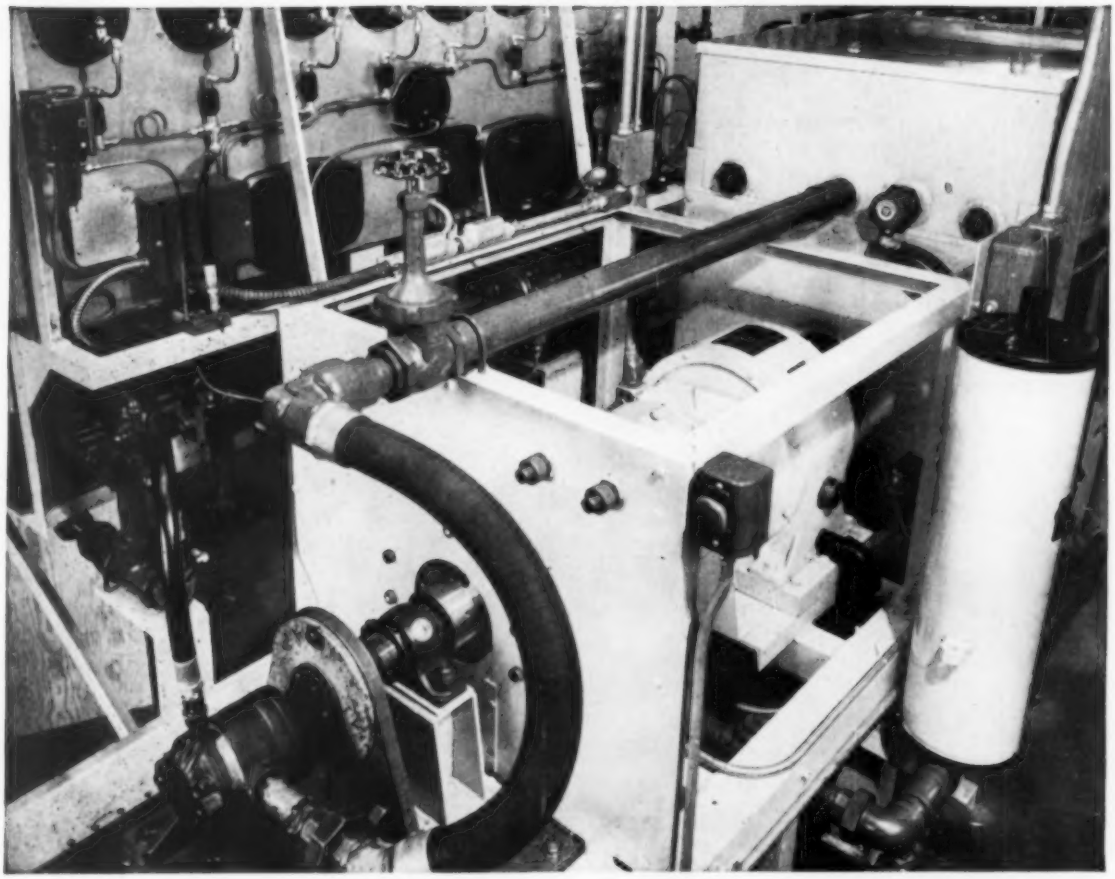

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FLUID POWER FORUM

MACHINE TOOLS

MACHINE TOOL HYDRAULICS FORUM

WHENEVER users of hydraulics start discussing fluid power equipment, leakage control takes top priority. Ideas on how to eliminate leakage kept coming up in the two day forum attended by more than 150 engineers who represented machine tool users, builders, and accessory manufacturers.

These men met at the Engineering Society of Detroit, May 24 and 25 to participate in discussions aimed toward improving hydraulic components, system designs and maintenance methods. Sponsored by Vickers Inc., the forum followed an agenda of questions which were submitted in advance by the men attending the forum. Major areas for discussion were: circuit problems, fittings and tubing, fluids, cylinders, pump and valve design, fluid motors, filters, maintenance.

...AN AH STAFF REPORT....

How can separate cylinders be easily synchronized?

Experience with circuit development for moving a large platen on a special drilling machine was detailed by Jim Tankard of Zagar Tool. Through a stroke of 8 inches, the 40 in by 60 in platen is held parallel within 1/64 inch. APPLIED HYDRAULICS will publish an article detailing this design in a forthcoming issue.

G. Brinkmann, of Ex-Cell-O, said a compensated fixed orifice is available with which synchronized motion can be maintained within an accuracy of about five percent.

H. Fritschi, of Cincinnati Milling Machine Co., described a synchronizing circuit using parallel resistances and balancing valves.

What are the trends toward combining hydraulic muscles with electronic controls?

Hydro-electronic servo systems which give uniform machine feed under varying load and temperature being tailor-made on

tion basis. There was no answer to the question: "How soon will there be wide-spread use of these systems?"

As an intermediate step toward complete change-over to electronic control, E. L. Dix of Bryant Grinder described a closed loop system in which valve actuating signals are taken from remote cam drum elements.

Is there a preference for hydraulic interlocking over electrical on complicated machines?

Electrical interlocking provides greater flexibility and ease of troubleshooting, said Ray Juengel of Ford. Interlocking with other machines in an automation line is easier to do electrically.

Approval of hydraulic interlocking was voiced by several users because of less maintenance as compared to electrical.

What's the experience with low energy static controls such as "Cypak"?

There is some investigation going on to apply this type of control system which has promise of reducing maintenance because it has no moving parts. Iron and steel chips do affect its operation. A new proximity switch which is magnetically actuated was discussed as a development which may one day replace the limit switch. Repeatability within 1/32 inch has been experienced.

On large broaching machines how do D.C. drives compare with hydraulics?

Jim Robinson, of Vickers, said that if pipe leaks are eliminated, the hydraulic drive is more efficient than the electrical. In support of the electrical drive, W. A. Murray, Ford Motor Co., pointed to lower inertia because oil mass is significant. Because variable voltage permits development of only the power to do the job, Murray believes that electrical losses would be less than hydraulic.

Robinson replied that the moment of inertia of a fluid motor is only a fraction of that of an electric motor of comparable power.

Would there be any value to using high volume, low pressure centrifugal pumps for rapid traverse and prefill operation?

On oil hydraulic equipment, functions of centrifugal pumps are of a secondary nature—supercharging or circulation. Prefill could be done advantageously with a centrifugal pump if a vertically mounted tank could not be used. While the system would be more complex, the tank could then be located anywhere.

What's the minimum cycle time to reverse a variable volume pump?

Time for reversal of pressure and suction ports varies with pump size. Piston pumps ranging in size from approximately 5 to 15 gpm can be reversed in from 1 to 2 seconds.

Have there been any new trends in manifolds?

Discussion of this question indicated that wider use is being made of solid block, drilled manifolds and brazed sandwich manifolds. For solid block designs, aluminum seems to be preferred because drilling long holes in this material is not difficult. Aluminum pipe plugs have been successfully used. When using aluminum, consideration must be given to its coefficient of expansion which differs from steel or cast iron. Roy Heerstrum, of Greenlee, said his company uses aluminum manifolds at pressures to 10,000 psi. A rubber plug backed up with a screw holds this pressure. Alloy 17T4 is used. Tensile strength of 60,000 psi is used to compute required wall thicknesses.

Earle Johnson, Rockford Machine Tool, said they have not experienced any problem from dissimilar metals due to electrolysis. They have used the aluminum manifold at pressures to 2000 psi.

Also reported was successful hydrogen brazing of cast iron to steel. Cast iron is used as the "meat" in the sandwich. One machine tool builder is using a brazed aluminum sandwich manifold.

Some experimenting with synthetic plastic materials between sandwich plates is going on. Problems here are: sealing at usual operating pressures, and compatibility with fluids.

Is there anything new to reduce or eliminate shock in hydraulic systems?

Nobody reported any recently developed product or idea to eliminate shock. However, knowledge of some schemes which have been in use could stand wider distribution. Modification of valve spools was discussed. Many of these modifications are tailor-made for a given machine; therefore, general rules would be difficult to publish. However, some designers have developed techniques and formulae

Continued on page 120

Articles on the following pages show how fluid power is being applied to improve performance of modern machine tools.

FLUID POWER TRACING

MACHINE TOOLS

HYDRAULIC TRACER CIRCUIT

. . . for contour milling machine

RISING and falling as they follow the contours of the templates, the rotating milling cutters traverse the length of the work.

• By W. C. Kraft

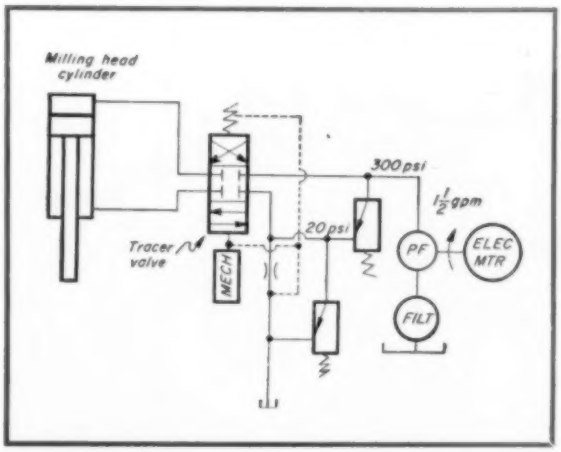
TWO important operations are hydraulically powered on a large 30 foot skin milling machine used by North American Aviation to sculpture one piece integrally stiffened wing sections for F-100 Super Sabre Jets.

One operation is the control of contour during the long longitudinal milling cut. Positioning of the work holding vacuum chucks is the second oil powered operation.

Designers and builders of this giant mill, Simmons Machine Tool Corp.,

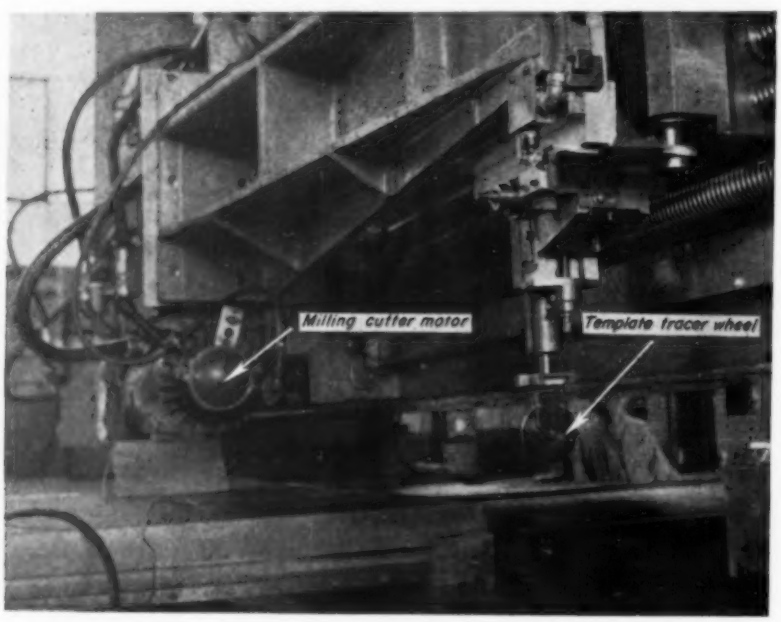
started with a Betts Pit type planer and created this machine which can perform in 3¼ hours a job that took sixty hours by earlier methods. The converted machine retained the two parallel ways, on which are mounted saddles carrying the gantry which spans the work area. Planer heads of the original machine have been replaced by two 60 hp, 3600 rpm milling heads. All traversing operations are powered electrically. Extensive changes were made in the electrical system to give greater speed ranges and control. ▼▼▼

W. C. KRAFT, *Chief Engineer, Simmons Machine Tool Corp., Albany, N.Y.*



CONTROL of milling head vertical movement to correspond with template contour depends on this circuit. The stylus wheel, bearing against the template, is the mechanical control of the tracer valve. The tracer valve, being mounted on the arm carrying the cutter head, moves with the head. This valve is a three position, 4-way valve which is positioned mechanically by the camming action of the stylus wheel on the template. The valve is spring offset to the downward feeding position and assumes this position whenever the stylus wheel is not in contact with the template. When hydraulic power is on, the power cylinder will pull the tracer down to make contact with the template. As contact is established, the stylus wheel tip will push the valve spool upward gradually cutting off the flow of oil to the cylinder until at center position movement ceases.

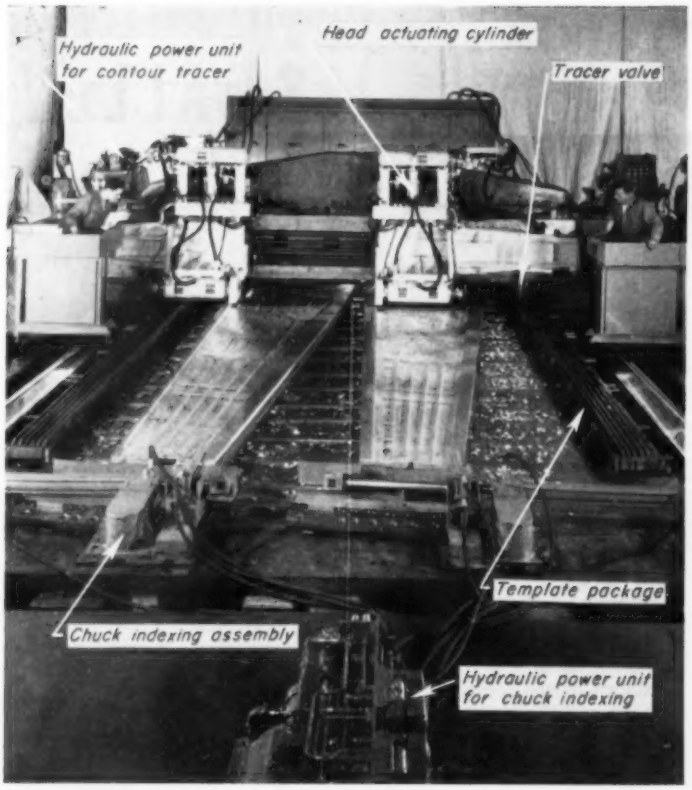
As long as the template contour doesn't change, the valve stays in neutral and the cutting head has no vertical movement. A change in template contour causes stylus wheel movement and corresponding head travel. The 20 psi back pressure on the tracer valve stabilizes valve action. Exhaust oil rushing through the venturi-like orifice creates a suction to pull excess oil from the tracer valve. To minimize friction on the tracer valve no seals are used. Any leakage past the spool is pulled to tank by the simple vacuum system.



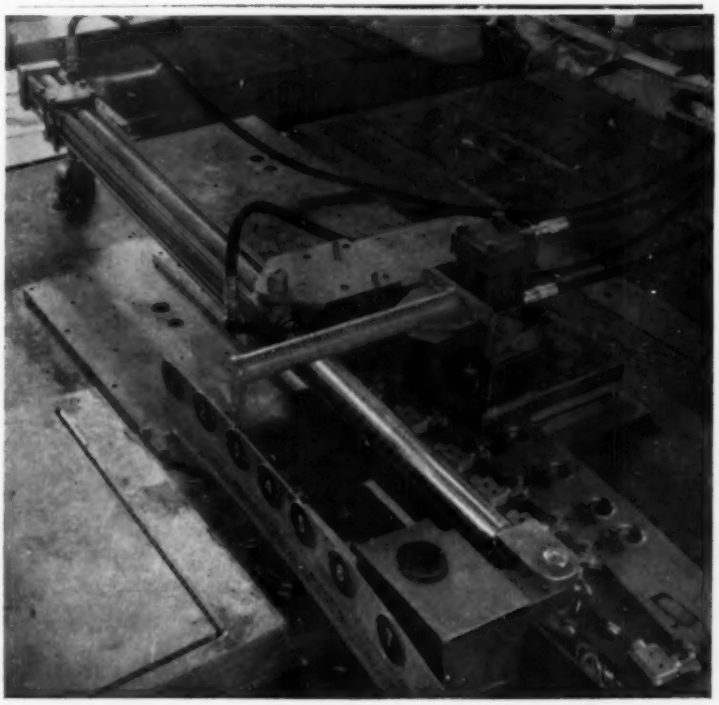
THE TRACER stylus head is mounted on a slide on an arm extending from the cutter head. Because of the length of this arm it is made of aluminum to keep deflection to a minimum. The hydraulic tracer valve is mounted in a carriage on the slide, and a special extension, with tubular bearings, carries the stylus wheel.

VERTICAL movement of the two cutter heads is controlled by the hydraulic tracer which follows a template. Each cutter head is controlled separately by individual template packages located on opposite sides of the machine. Air cylinders, either side of the head actuating cylinder, counterbalance the weight of the milling head.

The hydraulic follower mechanism permits an accurate rise and fall at 75 ipm and will duplicate the template within ±.002 inches.



WORK is held by vacuum chucks which are pivoted about a pin located near one end. The chucks are made of kirksite and a groove extends around the periphery of the top surface. A vacuum pump attached to the groove withdraws air beneath the work placed on the chuck. The end of the chuck furthest from the pivot pin is connected to this chuck indexing device. The chuck is pivoted by the long cylinder. Its correct position is determined by limit switches located on the indexing bar. When in the correct position, the chuck is locked by the lockpin which is actuated by the short vertical air cylinder. When in automatic operation, the complete action of selecting the correct position, moving through the arc of rotation, and the engaging of the locking pin is performed in proper sequence. The operator only has to check the visual index bar with larger numbers corresponding to chuck positions.



FLUID POWER MACHINE TOOLS

VERTICAL CHUCKING

SMALL VOLUME FLOW

. . . for very fine

• By Karl Schubert

IN Germany, before the war, a metering pump was developed which permits accurate control of flow over a very wide range of adjustment and down to about 1 to 1.5 cubic inches per minute. Hundreds of vertical spindle chucking machines, of the type shown in Figure 1, have been built using the feed circuit shown in Figure 2.

Heart of the feed arrangement is the large volume pump and metering pump, Figure 3. The large volume gear pump and the metering piston pump are combined in one cylindrical unit with the drive on one end and the metering adjustment on the other. This design makes the whole unit very practical for panel mounting.

Rather unique is the metering pump which has no mechanical drive for the 5 or 7 metering pistons arranged around the rotating distributor shaft. The pistons are entirely free. Their reciprocation is accomplished by pressure oil from the large volume pump.

Stroke of the pistons is controlled by fixed stop screws and adjusted by stop pins through a logarithmic cam. The pistons are located in a stationary housing and the pressure oil is supplied alternately to one or the other side through the rotating distribution shaft.

ADJUSTMENT WITH LOGARITHMIC CAM

By elimination of any mechanical cranks, joints or links, the pistons in the metering pump can be very light and the pressure difference for operation very low, approximately 20 to 40 psi. Using a logarithmic cam gives very exact adjustment of output from the metering pump in the low range where it is most important.

Figure 2 shows how this flow control system is used to regulate speed of a tool slide on the vertical chucking machine. During rapid approach the large volume pump delivers oil to the cylinder. This is a differential circuit: oil out of the rod end of the work cylinder joins with delivery from the pump and flows to the blank end of the cylinder to give rapid advance. When the cam on the moving tool slide closes the deceleration valve, the system goes into feed. Oil pressure from the large volume pump builds up to the setting of the relief valve. Oil from the large pump is also powering the motion of the pistons in the metering pump which is delivering oil to the blank end of the work cylinder for the length of the cutting stroke. During feed, the spool of the shuttle valve is balanced by pressure on either side. Feed rate is determined by the

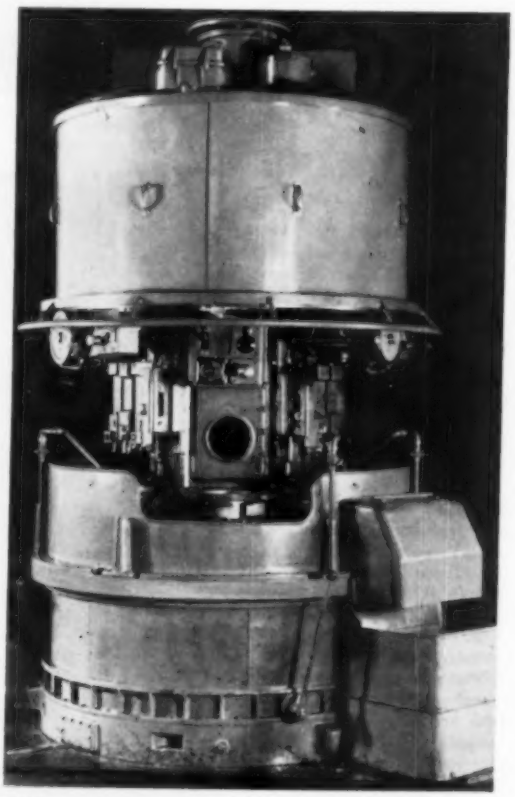


FIG. 1. EACH of the five vertical tool slides is powered by a separate feed unit. On a typical job each spindle moves at a different feed rate.

KARL SCHUBERT, *Design Engineer, National Acme Co., Cleveland, Ohio*

METERING

cutting feeds

adjustment on the metering pump.

At the end of the feed stroke, the tool slide stops against an adjustable stop rod. The resulting pressure increase on the blank end of the work cylinder puts the spool of the shuttle valve out of balance causing it to change position and permit oil from the large volume pump to flow to the pilot end of the directional control valve. This valve shifts to "return" position, opening the rod end of the work cylinder to pressure and the blank end to tank.

Cycling of each of the five tool slides on this vertical machine is electrically interlocked with a hydraulically powered indexing device and chucking mechanism. This machine uses oil power for all motions. The accuracy and wide range of adjustment of the oil driven feed pump resulted in precision machining of the large parts which were turned, faced and chamfered. ▼▼▼

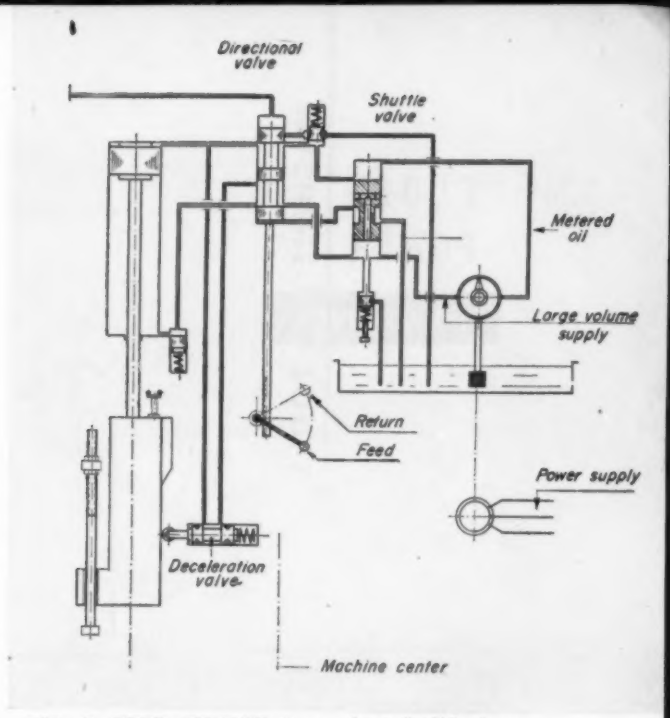


FIG. 2. FEED CIRCUIT for each tool slide is a differential circuit during rapid approach. Closing the deceleration valve puts the circuit into feed. This circuit has the back pressure characteristic and efficiency of a meter-out system. However, the metering pump provides a range and accuracy greater than conventional metering valve circuits.

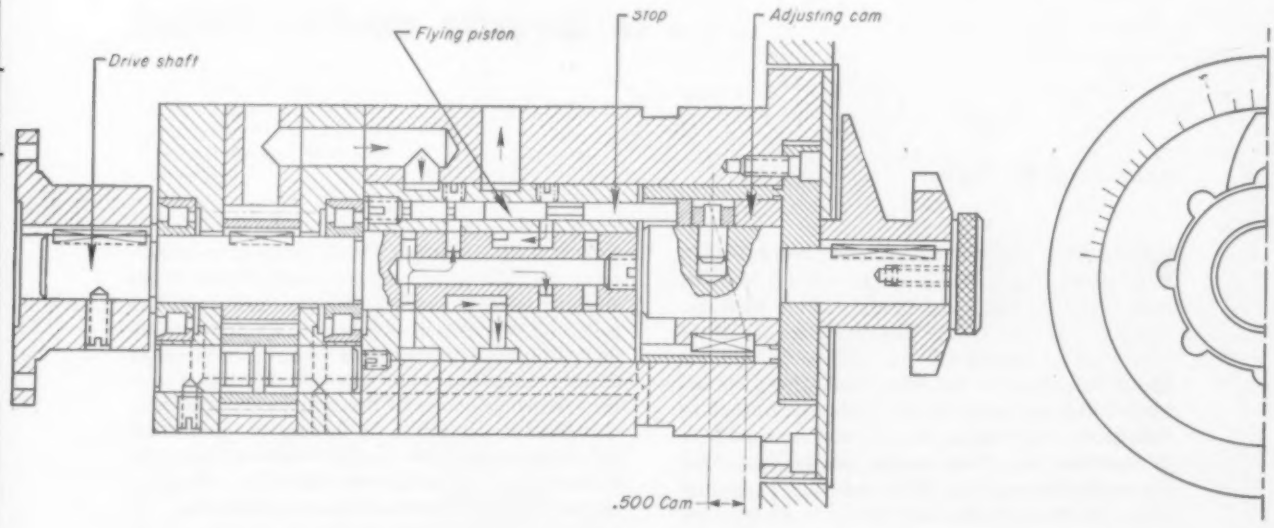
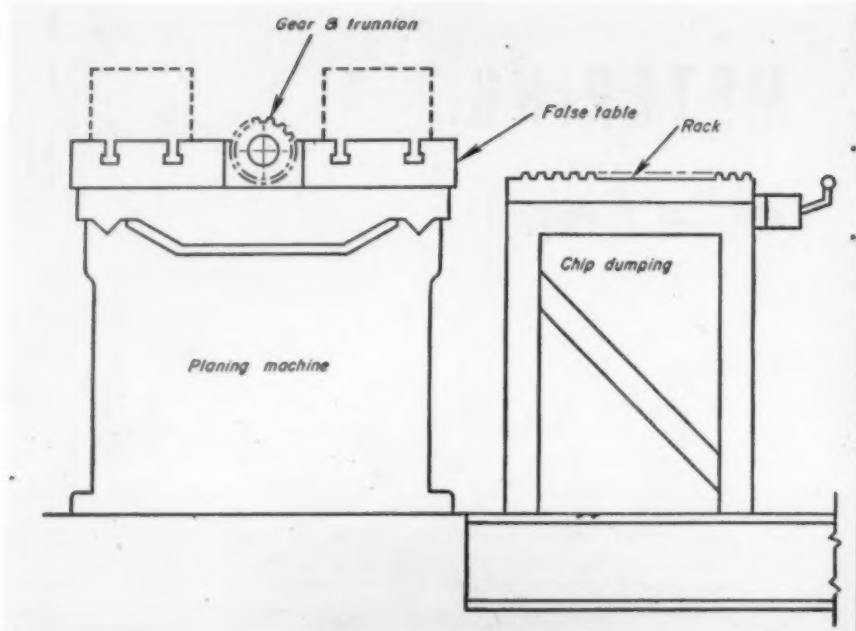


FIG. 3. DESIGN of the large volume pump and metering pump into one cylindrical housing makes the unit convenient for panel mounting. Logarithmic cam which controls stroke of metering pistons has a ½ inch adjustment.

FLUID POWER

MACHINE TOOLS

PLANING



DESIGN OF A PLANER LOADER

. . . to increase machine output

• By John R. Fawcett

PLANING is probably the most efficient means of preparing flat surfaces of castings for machine tools where the quantities do not warrant an elaborate setup. Ordinarily the parts are clamped on the planer table, causing the machine to be idle for about 50 percent of the time, while the parts are loaded and unloaded. If the parts are carried by false tables which can be fixed to and removed from the machine table, then loading can be done while the machine is working. The production of the machine can then be increased by 75 to 90 per cent.

The traverser shown in Figure 1 is used for lifting the false tables on and off the planer. It consists of two identical units, one for each end of the 12 foot long false table, which move in unison to carry the false table from the setting frame to the machine table, a distance of about eight feet. The particular problems involved in the application were the hydraulic synchronization of the movements of the two units and the elimination of trailing hose for conveying power to the lifting cylinders. Synchronization was solved by the use of special flow balancing valves. Hose was eliminated by using the hollow ram of the horizontal cylinder to carry oil to the moving unit.The circuit is arranged so that pressure can be maintained in the lifting cylinders irrespective of the horizontal movement. It is considered that the practical success of the scheme was greatly enhanced by the elimination of the hazard which would have been presented if hose or

JOHN R. FAWCETT, *Hydraulic Consultant, Timperley, Cheshire, England*

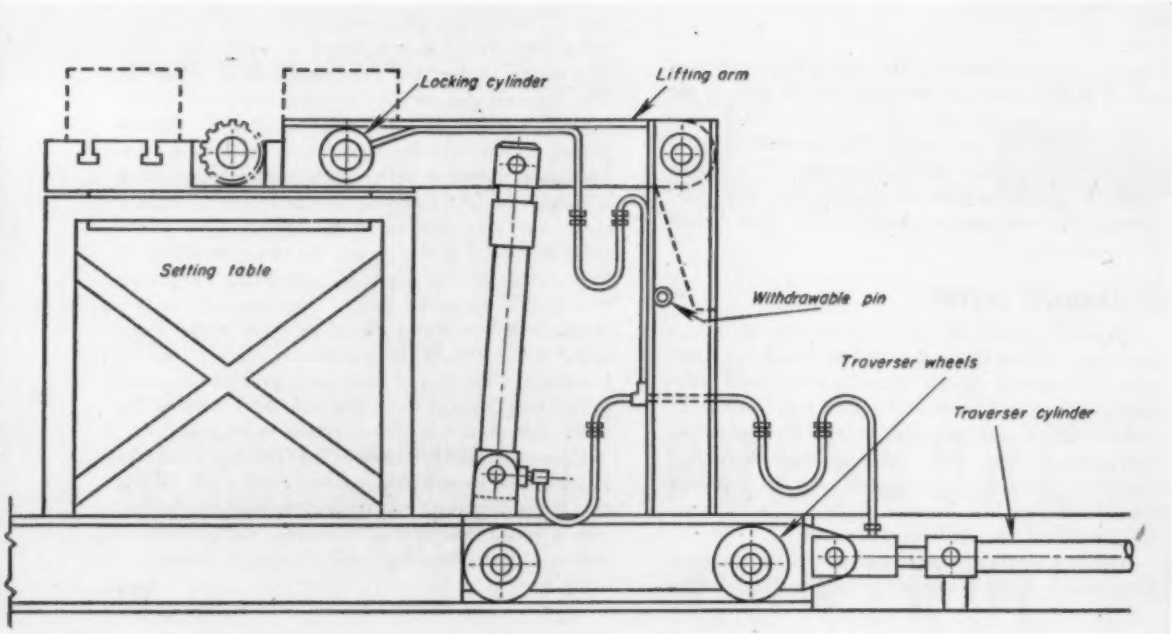


FIG. 1. Layout of planing machine loader shows one of the two traversers. Each traverser is located at an end of the 12 foot false table. The empty loader moves to the machine to lift table and machined work off the planer.

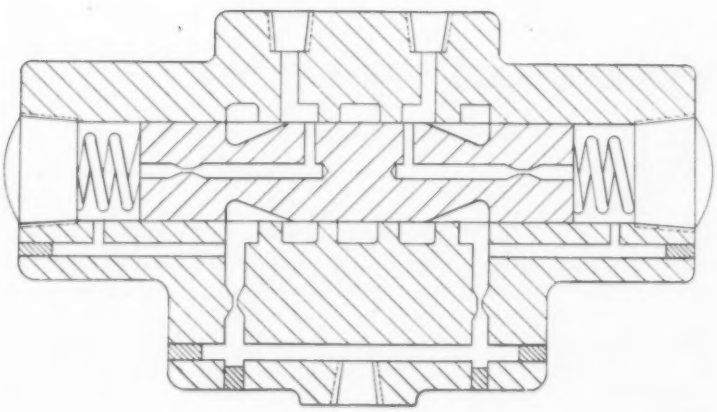


FIG. 2. Cross-section of "In" flow dividing valve which keeps cylinders moving forward in unison. Keelavite Rotary Pumps & Motors Ltd.

cables, capable of accommodating a movement of eight feet, had been used.

To permit being picked up and carried, each false table has a trunnion and spur gear mounted at its ends. With the machining operation completed, the traverser moves forward and its lifting arms engage the trunnion on each end of the table. After the trunnions are secured by hand with end caps, the table is lifted, moved back and dropped onto gear racks. Now, as the traverser moves back, the table having the spur gears engaged with the racks makes one complete revolution so that all chips are dumped. The table is now lifted and dropped onto the setting frame where the trunnion caps are removed and the traverser withdrawn.

The false table is then pushed along rollers on the setting frame by a false table which has been loaded with work ready for machining. This pushing action is powered by a separate hydraulic circuit.

Traversers are now moved forward to pick up the second false table and transfer it to the machine table where it is clamped and ready for machining. During machining, work on the false table which had been removed from the planer and placed on the setting frame is unloaded and new work is fastened to the false table ready to be transferred to the planer.

MECHANICAL CONSTRUCTION

Traverser wheels, Figure 1, run in channels set into the floor. The horizontal cylinder has a tubular

ram which is drilled near the piston head and connected at the outer end by short flexible hose to the lifting and locking cylinders. Pressure oil is conducted from the rod end of the horizontal cylinders to the cylinders on the traverser. The setting frame is provided with an independent hydraulic system for interchanging false tables—this circuit is not shown.

HYDRAULIC SYSTEM

Figure 3 shows the two traverser units which have two identical sets of cylinders which are operated by common valves. There is a balanced relief valve (1) set at 700 psi and a pilot relief valve (2) reduces this to 300 psi until solenoid valve (3) is energized. Valves (10) prevent the load from dropping suddenly and guard against damage should the pipe line fracture. Flow valves (6) control the speed rate in both directions.

As it is essential that the two units of the traverser keep in step. Flow in and out of the head ends of the cylinders is controlled by flow divider valves (7) and (8) which are alternated by solenoid hydraulic valve (9). This valve is wired in with valve (5). The design of the "In" valve is shown in Figure 2. The flow divides at the valve entrance and passes through two pairs of metering jets and the control piston to the cylinder lines. Any unbalance flow causes a pressure differential across the piston which moves in the appropriate direction to slightly close one line and open the other. The "Out" valve is similar in design but the piston is arranged to operate in the opposition direction. To compensate for any small lack of coordination, the traverser cylinders are connected by a line with a small adjustable valve. When a traverser contacts one of the stops at the end of the travel, pressure is maintained long enough to ensure that fluid flows to the other side until resynchronization is attained.

Pressure to the rod ends of the traverser cylinders is controlled by solenoid hydraulic valve (4). When this is open, pressure is applied through the hollow piston rods, combined flow control and non-return valves (10) to the lifting and locking cylinders.

▼▼▼

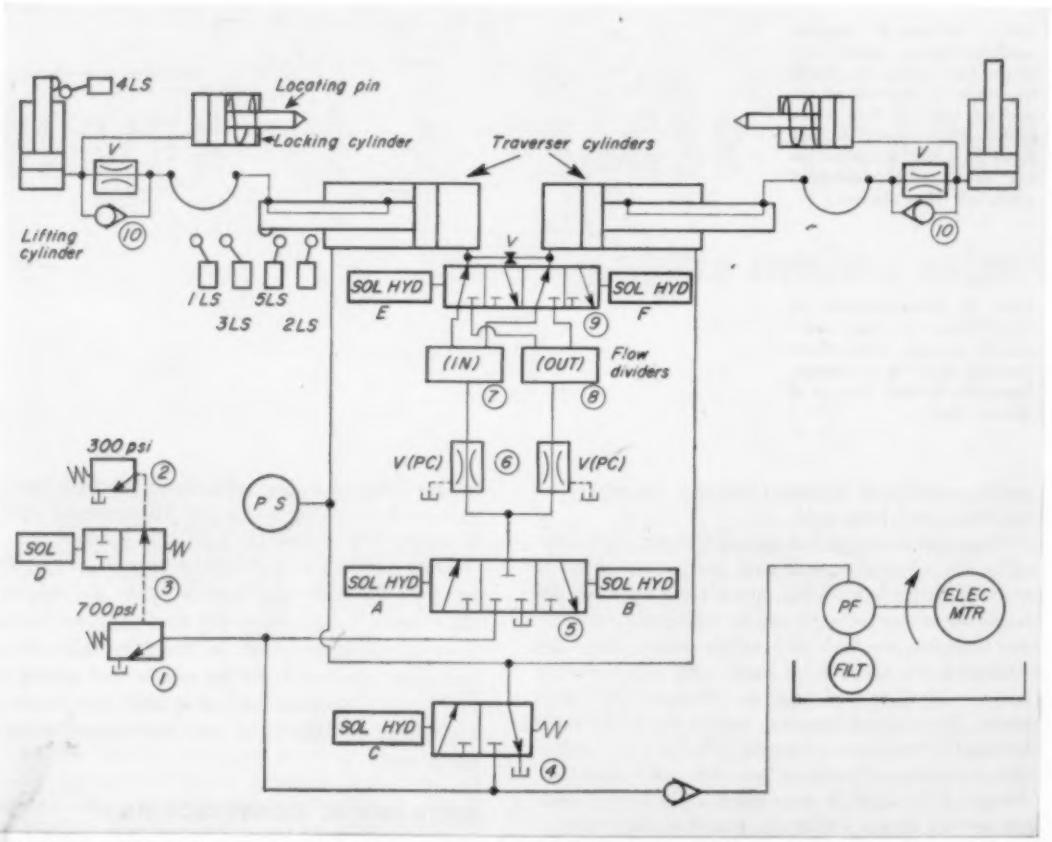


FIG. 3. Running a fluid line through the piston rod of the eight foot stroke traverser cylinders eliminates long hose connections. Pressure can be maintained on the lifting cylinders during horizontal travel in either direction.

FLUID POWER

COUNTER-SINKING

One of the inherent advantages of hydraulic control is its ability to maintain a preset pressure and the ease with which this pressure can be adjusted. Flexibility was an important requirement for this redesigned countersinking machine, so an oil circuit replaced the spring system which was inadequate for the newer types of metals.

PRESSURE CONTROL

. . . for accurate countersinking

• By Alexander D. Roubloff

EVER since metal skin replaced canvas for aircraft sections, aeronautical production engineers have had a problem of precision countersinking. Thousands of rivets are used to hold the sheets which cover the structural frame of an airplane, and each rivet must be perfectly flush with the outer surface. Rivets which are too high or too low create minute air turbulances. When these small turbulances are compounded, a serious condition results reducing the speed of the aircraft and requiring more fuel and less payload. The manufacturing problem resolves itself into two parts: (1) the rivets must be manufactured with uniform head size, and (2) the rivet hole must be countersunk to the exact depth of the rivet head.

Fifteen years ago, the problem at that time was solved with a spring-loaded spindle head. The drilled hole was placed over a retractable pin on an anvil. A foot, sliding on the spindle, then contacted the work and held it in place with spring pressure. The spindle then continued down to countersink the hole to a depth determined by spring force. Both the anvil force and the countersinking force were non-adjustable.

Machines with this type of spindle were successful for countersinking holes to 3/8-inch diameter in aluminum alloys, but when the airframe builders began to use titanium and stainless steel with larger diameter rivets, an improved method was required.

MORE POWER, GREATER FLEXIBILITY

First, it was necessary for the new machine to have more power available at the cutter. Second, it had to possess flexibility for the wider range of work requirements. An oil circuit was the obvious choice for the new machine, both from the consideration of design and economy. The new machine follows the same sequence as before, except that it incorporates a low-force dwell at the end of countersinking in order to clean the hole. Adjustable pressure for the countersinking tool permits cutting a variety of hole sizes in a number of metals. Adjustable pressure for the work holding foot prevents the foot from marring the surface of the workpiece. Excessive foot pressure over a soft metal

ALEXANDER D. ROUBLOFF, *Chief Engineer, Wiesner Rapp Co., Inc., Buffalo, N. Y.*

PRESSURE CONTROL FOR COUNTERSINKING

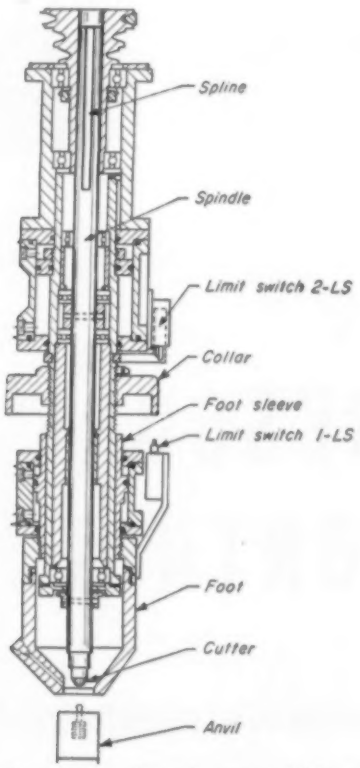


FIG. 1. Cross-section through countersinking spindle.

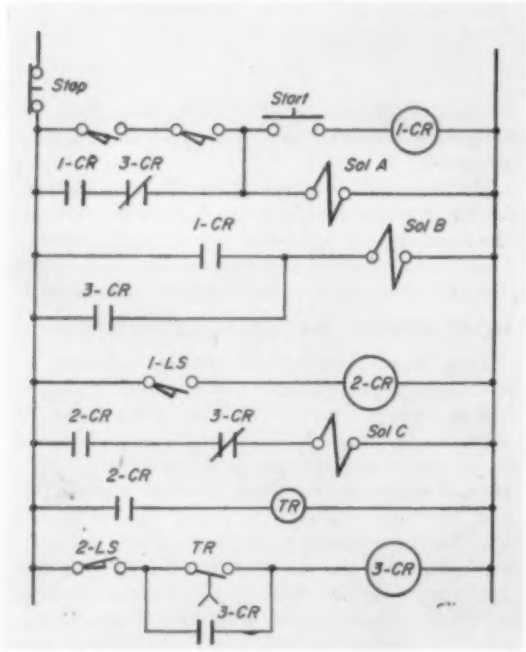


FIG. 2. Electrical control circuit.

will cause an indentation under the foot, while insufficient foot pressure over a harder metal will not provide sufficient holding force. By having foot pressure adjustable, force can be increased when machining ferrous metals which require greater thrust on the cutter, and decreased when machining soft, aluminum alloy. The hydraulic control also permits regulation of the cutter feed. This permits adjustment for proper chip load and for better, cleaner cuts and longer tool life.

MACHINE SEQUENCE

The countersinking cycle shown in the circuit of Figure 2 is started when the operator depresses a foot switch to energize relay 1-CR. This relay in turn energizes solenoids A and B so that pressure fluid is directed first through the two 4-way valves and the pressure reducing valve to lower the foot. When the foot bottoms, pressure builds up to the setting of the sequence valve which opens to direct fluid through the flow control valve to lower the spindle for countersinking.

The flow control valve controls spindle feed rate. The pressure reducing valve controls foot force, and relief valve R-1 regulates spindle force.

When the cutter reaches the end of its stroke, limit switch 1-LS is actuated to energize relay 2-CR. This relay actuates solenoid C and the timer. Sole-

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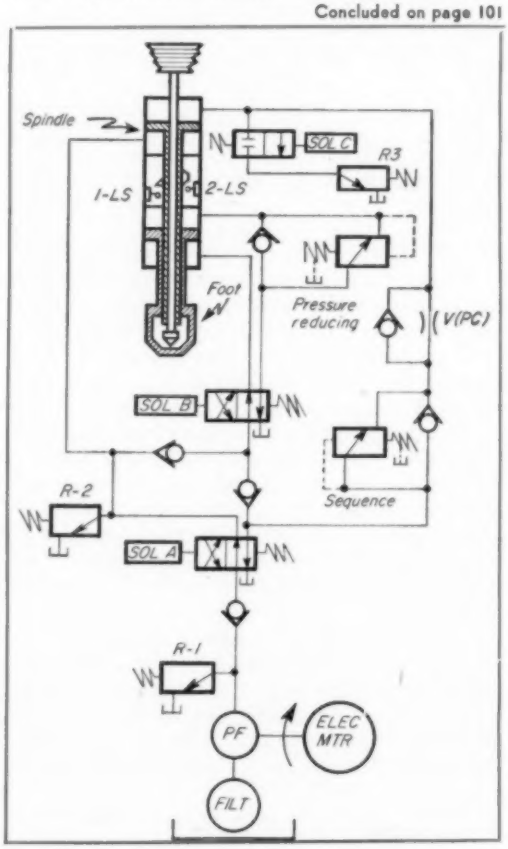


FIG. 3. Hydraulic system.

COMBINATION PUMPS

...power grinding machine

FLUID POWER

MACHINE TOOLS

GRINDING

FIG. 1 FOR CONVENIENCE OF MAINTENANCE, control valves are panel-mounted on a swinging door at the back of this grinder. Hydraulic hoses which connect valves to machine components provide a cushion in each of the hydrauic lines.

• By P. O. Wernicke and J. C. Horth

In order to obtain the various flow rates required for this grinder, combination pumps consisting of a variable-volume, radial piston pump and a fixed-volume gear pump were selected. The output from the supercharged piston pump section is preset manually and selected electrically.

ON a grinder recently developed at Mercury Engineering Corporation, various flows had to be supplied to several circuits at different times in the machine sequence. The machine is an automatic, two-spindle, vertical, wet-face precision grinder with two rotary work-holding fixtures and a transfer mechanism. It also has automatic, size feedback and automatic wheel dressing. In addition to raising and lowering the two grinding heads at controlled rates, and transferring the work from the semi-finish station to the finish station, fluid power is used to chuck the work, gage it after grinding, and dress the wheels.

PUMPS

Two combination pumps are installed on the machine. Each of these consists of a 4.9-gpm, radial piston pump

P. O. WERNICKE, *Sales Manager*, J. C. HORTH, *Chief Engineer*, *Mercury Engineering Corp., Milwaukee, Wisc.*

and a 5.6-gpm, gear pump. The piston pump has a maximum pressure of 1100 psi, and the gear pump supercharges the piston pump at a pressure of 130 psi. In addition, the gear pump may be piped to supply external circuits. The combination pump also contains a 3-position, 4-way, solenoid-operated valve to direct flow to or from two control pistons which position the piston pump to control the output. An opposing control piston in the pump can be supplied from the gear pump or from an external source. Two preset outputs can be selected electrically. These outputs are set with manual controls. Operation of the pump shown in Figure 2 is as follows:

The gear pump delivers oil under pressure to control piston *a* on the left and also through the 4-way solenoid valve to control pistons *b* and *c* on the right. When solenoids *A* and *B* are de-energized, gear pump pressure is acting on control pistons *a* and *c*. The piston pump is then in neutral position and no oil is delivered from pump port *A* or *B*.

When solenoid *A* is energized as shown, gear pump oil is blocked at the valve and control pistons *b* and *c* are drained. Piston *a* then moves the piston pump on stroke to deliver oil at port *A*. Pressure at port *A* and suction at port *B* act to shift the pilot-operated suction valve, so that the gear pump delivers oil to the piston pump intake. If the pump is supplying oil to the head end of a single-rod cylinder, and the rod end is drained back to port *B*, pump output will be greater than intake and additional oil will be supplied by the gear pump. If the pump is supplying the rod end, and the head-end oil is drained back to port *B*, pump intake will exceed output, and this excess will join gear pump output to flow through the suction valve and gear pump relief valve to tank.

When solenoid *B* is energized, gear pump oil flows through the control valve to pistons *b* and *c*. This forces the piston pump slide block to the left for delivery of oil at port *B*. The pilot operated suction valve shifts directing gear pump output to the port *A* side of the piston pump.

Delivery from port *A* is preset by control knob *A*. Output from port *B* is preset by control knob B. An additional adjusting nut for piston *c* permits setting the pump for a delivery when neither solenoid is actuated, though the pump is usually in neutral position under this condition.

WHEEL CONTROL CIRCUIT

In Figure 3 when solenoid *B* of the pump is energized, the pump delivers oil at 600 psi through a pair of flow control valves which divide the flow between the two wheel cylinders. The rate of flow is regulated by manually adjusting the pump output. Oil is connected through the de-energized solenoid valves to raise the wheel cylinders. This acts as a fail-safe arrangement in case of power failure or failure of a relay or solenoid.

The wheel cylinders lower by their own weight, and oil is forced out of the wheel cylinders through the flow control valves which govern downward feed rate. When the 2-position solenoid valves are actuated, oil flows out of both the large-area section of the wheel cylinders and the small-area section. Because the rapid-speed adjusting flow control valves, 1, are set for a much larger opening than the slow-speed adjusting flow control valves, 2, most of the oil flows through valves 1, through the solenoid valves, and off the 100-psi

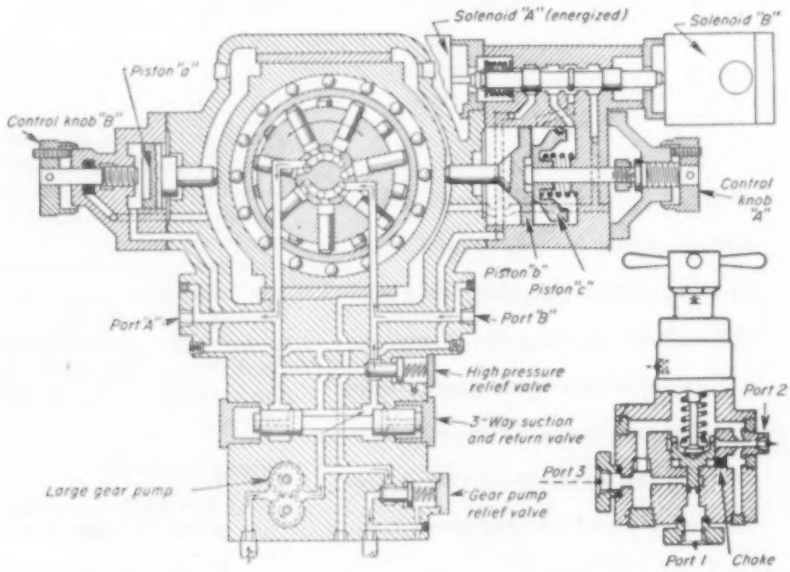


FIG. 2 COMBINATION PUMP contains gear pump for stroking piston pump and supplying it with supercharged oil. Control valve is used for remote control to pressure-compensate pump and return it to neutral position at required pressure.

Courtesy The Oilgear Co.

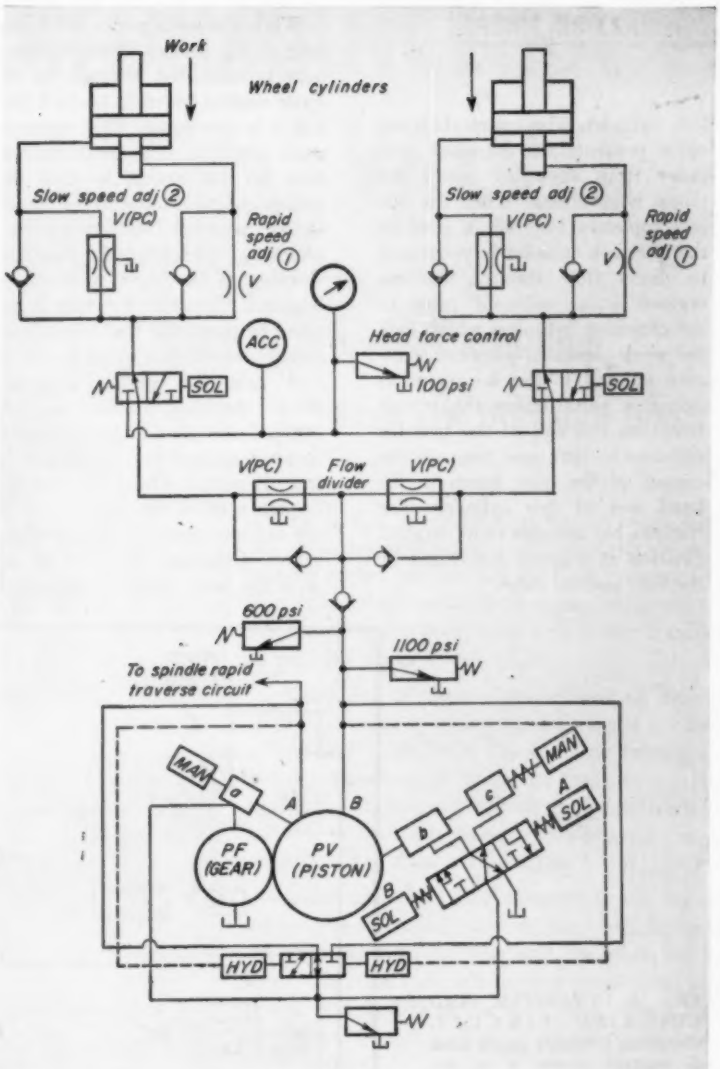


FIG. 3 WHEEL CONTROL CIRCUIT. Construction of wheel cylinders provides simple method of obtaining rapid approach and slow feed. Flow from cylinders is mostly through large orifice of flow control valve 1 until piston enters small-area section of cylinder. Discharge is then forced through flow control valve 2 for slow feed.

relief valve. The wheels move down at a rapid approach until the pistons enter the small-area section of the wheel cylinders. At this time, fluid in the large-area section is forced out through valves, 2, and the wheels complete their travel at a slow feed rate.

The relief valve permits control of the force on the wheels. Increasing the pressure setting, increases the back pressure on the wheel cylinders and decreases the resultant downward force. The accumulator stores oil to maintain back pressure, should the wheel suddenly hit an obstruction and stop feeding. The accumulator also allows the wheel to retract momentarily should the revolving workpiece be badly misaligned and wobbling in the chuck. The accumulator functions as the hydraulic equivalent of a mechanical spring.

TRANSFER AND CHUCKING CIRCUIT

The transfer bar takes work pieces which have been semi-finished at the first station and places them on the second station for finish grinding. It also unloads the finished pieces from the second wheel. The bar is moved up and down by one cylinder and forward and back by another cylinder. Referring to Figure 4, at the beginning of the cycle, solenoid *A* in the pump is energized so that the pump delivers oil from port *A* to raise the interlock cylinder. When the transfer bar is fully raised, a port in the interlock cylinder is uncovered to allow flow to retract the transfer cylinder to the forward position. This moves the transfer bar 32 inches to the left.

Solenoid *B* in the pump is then actuated, so that flow is from port *B* of the pump to lower the inter-

lock cylinder. The counterbalance valve prevents the interlock cylinder from dropping while the pump is reversing. When the bar is completely lowered, a port in the interlock cylinder is uncovered to direct flow through the energized 3-way solenoid valve to the chucking cylinders which lock the work pieces in position. Pressure applied to the 4-way, pilot-operated valve opens the circuit from the rod end of the transfer cylinder to tank and connects the output of the gear pump to the head end of this cylinder. The transfer bar reverses to its original position at a speed controlled by the flow control valve.

While the work pieces are being held in the chucks, chucking pressure is connected through the remote control valve to control piston *a* in the pump. This arrangement provides pressure compensation for the pump, so that the pump is positioned to a short stroke position at the proper chucking pressure. A sectional drawing of the valve is shown in Figure 2. Chucking pressure is applied to port 1 of the valve. Gear pump pressure is applied to port 2 and aids the spring pressure. When chucking pressure reaches 500 psi, the valve piston is pushed upward against the spring, blocking off port 2. Chucking pressure is then applied through port 3 of the valve to control piston *a* of the pump. Chucking pressure is set with the handwheel on the valve. The pump is returned to a position near neutral so that only the oil necessary to make up leakage and slip is delivered to the system. This prevents excess heating of the oil during chucking.

HOSE CUSHIONS FLOW

All control valves are panel mounted on a swinging door on the back of the machine. The hydraulic lines are connected to the machine through a series of hydraulic hoses. These hoses provide a cushion in each of the hydraulic lines. The size of the hydraulic lines was selected for a maximum line velocity of 10 feet per second. The reservoirs of the two pumps are piped in common to provide a total system capacity of 25 gallons. ▼▼▼

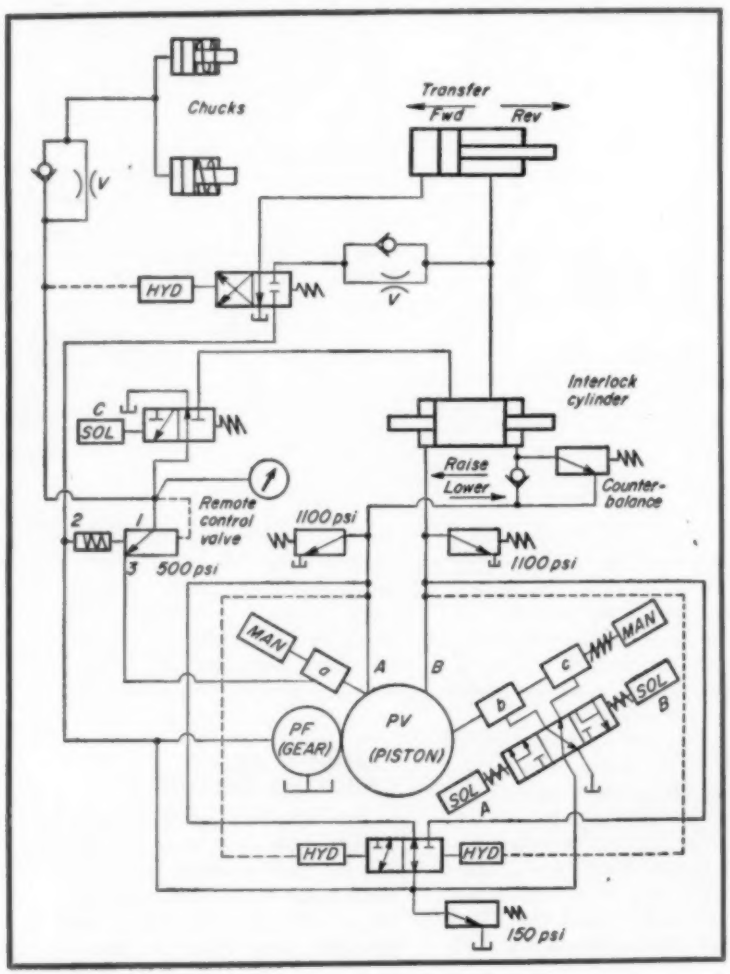
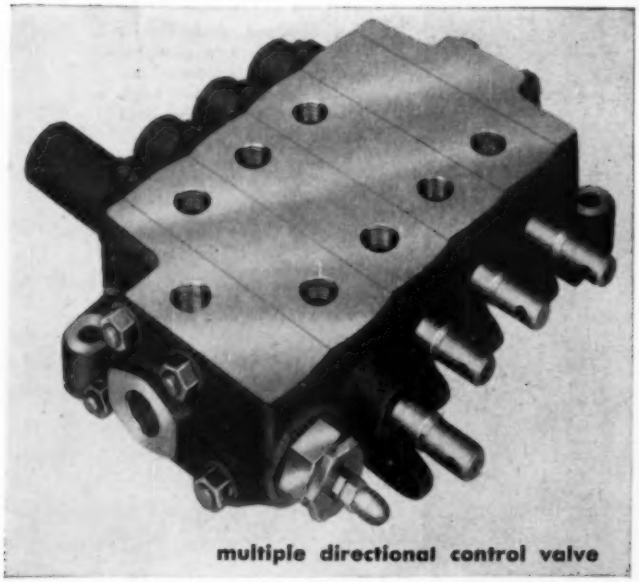
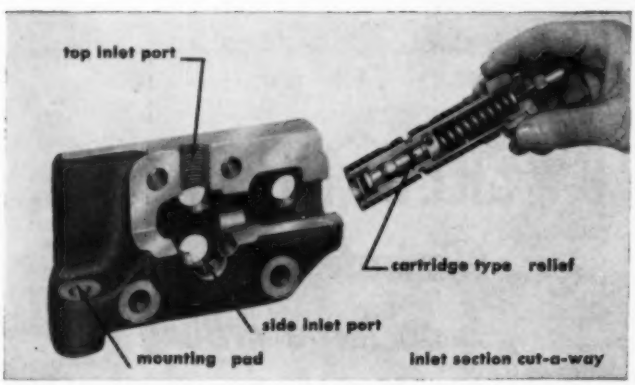


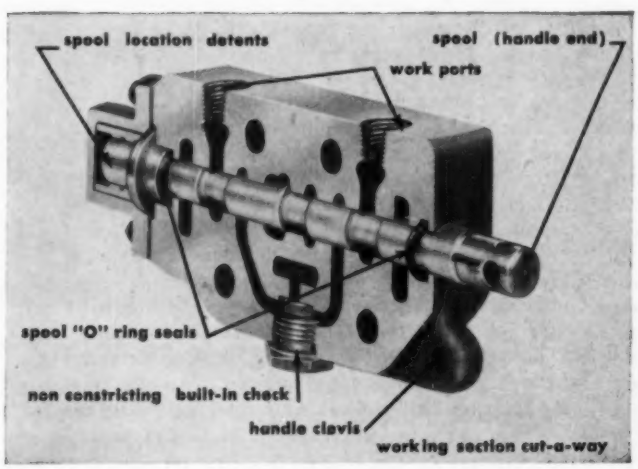
FIG. 4. TRANSFER AND CHUCKING CIRCUIT. Chucking pressure piped back to control piston *a* in the combination pump acts to pressure-compensate the pump. At chucking pressure of 500 psi, pump delivers only the oil required to make up leakage.

ALL NEW PERFORMANCE RATED VALVES



multiple directional control valve





. . . prevent load-drop

. . . have low pressure loss

HERE IS A NEW directional control valve having greatly improved operating characteristics. Now you can get higher performance from oil hydraulic cylinders and motors because the pressure loss inside these valves is less, therefore, more fluid power is available to perform work.

The rating of these valves is based on their performance under operating conditions and not by the size of their work ports. You can now determine the valve pressure loss and know the total power required to do the job. It is easy to pick the correct size of the valve to control this power with a pressure loss low enough to not cause excessive heat.

Constructed with solid, balanced spools, the valve working sections each have a built-in check; so that no pressurized return flow and, therefore, no load drop, can occur even if two or more sections are in operating positions at the same time. Check valves are located so that they cause no constriction of oil flow passages.

Side and top inlet and outlet ports are provided, and direct return tank mounting is available. Valves can be furnished with ports designed for tapered thread or SAE split-flange connections. Working sections having three-way, three position; four-way, three position and four-way, four position actions are available and can be assembled in any combination or sequence.

Other features include greatly reduced resistance to flow through internal passages, sealing by O-rings instead of gaskets and a unique cartridge type pressure relief valve. . . . For complete data, write to Dept. A-27, The Commercial Shearing and Stamping Company, Youngstown, Ohio.

COMMERCIAL SHEARING AND STAMPING

FIG. 1. TWO holes may be drilled simultaneously by the opposed drill heads. The hole pattern is maintained by index templates which position the work horizontally and the drill heads vertically.

FLUID POWER MACHINE DRILLING TOOLS

OIL POWERED INDEXING

. . . eliminates layout time on large drilling job

TAKE a round piece of steel, 6 feet in diameter, 5 inches thick. Drill and ream 2000, ¾ inch diameter holes in this part. How would you do it? How long would it take? If you used a conventional radial drill you might take 60 hours to do this job. There would be 14 hours for layout and center-punching, 8 hours for drill spotting, 30 hours to drill and another 8 hours to ream. A very impressive total—but then it's a big job, and who does a job like this very often? Manufacturers of heat exchangers, condensers, evaporators and heaters do this kind of job on tube sheets and baffles. Giant nuclear power installation are one of the users of big heat exchangers.

The need for faster equipment to drill tube sheets led to the development by Walter P. Hill, Inc., Detroit, of the automatic drilling machine shown in Figures 1 and 2. This giant electrically operated, hydraulically controlled machine combines the speed of a two-way drilling machine having a maximum flexibility with the accuracy of a horizontal boring machine. On this machine, the large 2000 hole drilling job which took 60 hours can be done in 10 hours. Layout, center-punching, drill spotting and reaming operations are eliminated.

Each job drilled on this machine is done by use

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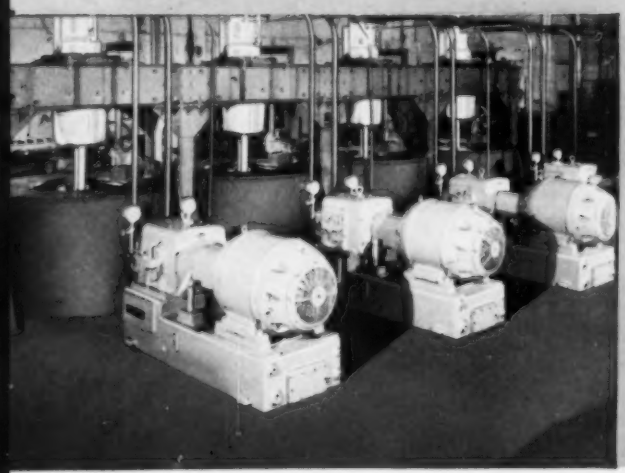


This Centrifuge at Abbott Laboratories

Leading house in pharmaceutical, drug and chemical field, Abbott Laboratories installed first Oilgear Drive on Tolhurst centrifuge in production department. Experience was so satisfactory it led to the inclusion of another Oilgear equipped Tolhurst centrifuge in their experimental laboratories.

SPECIFICATIONS: Speed continuously variable from zero to 1200 rpm max. (in this case). Full control of acceleration/deceleration speed and rate. Permits that infinitely modifiable speed best suited to loading, washing, spinning and unloading.

Photo Courtesy, Chemical Processing Magazine

This Centrifuge at powder plant in east

In a somewhat different application, these 4 Oilgear 60 hp "Any-Speed" Drives serve Tolhurst centrifuges in powder plant in the east. Centrifuge accelerates to 300 rpm for loading, to 900 rpm for 15-minute centrifuging, then decelerates to 70 rpm for "plowing." Unloading is automatic.

Tolhurst is a division of American Machine & Metals, Inc.

OILGEAR
Fluid Power

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

of notched index bars as shown in Figure 3. One index bar is used at each vertical head to permit independent vertical positioning of each drilling head. The third index bar controls horizontal positioning of the work holding fixture which is mounted on the oil driven table. This fixture is traversed between the two opposed drilling heads.

A typical operation starts with the vertical indexing and locating of each of the 3800 pound power heads to individual locations corresponding to the desired hole pattern. Vertical and horizontal index bars are then locked.

Automatic drilling is initiated by pushbutton. The opposed heads automatically go through a hydraulically controlled feed cycle to complete two holes at a time. The table index cylinder is then released; the table is horizontally indexed and again locked ready for another drilling cycle. In this way two rows of holes are completed. To drill more then two rows, the drill heads are indexed vertically to new rows and the table indexed in a reverse direction to drill two holes at a time at each position.

Index and drill feeding is powered by a 12 gpm variable volume vane pump. All directional controls are electrically actuated. Each drill is powered by two 3¼ diameter, 12 inch stroke cylinders controlled by a meter-out circuit. Switchover from rapid approach to feed is controlled by a cam operated deceleration valve.

Index lock cylinders are small—2 inch diameter, 1½ inch stroke. These index cylinders operate an escapement which permits index of the work fixture and table from hole to hole. The same arrangement is used for vertical indexing of the heads. The main fixture cylinder rapidly traverses the table from load to drill and will also retract the fixture for tool change.

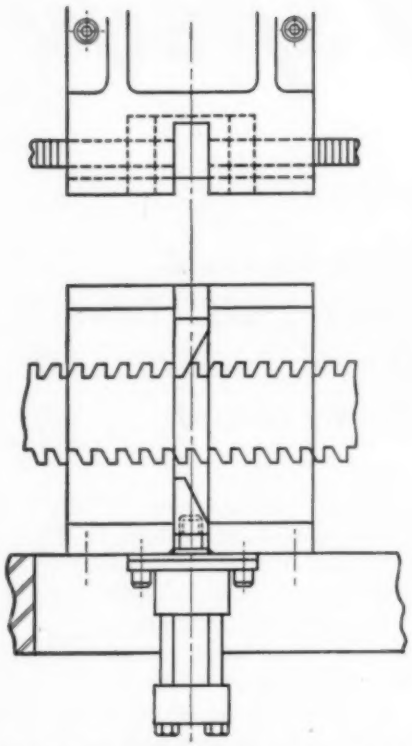
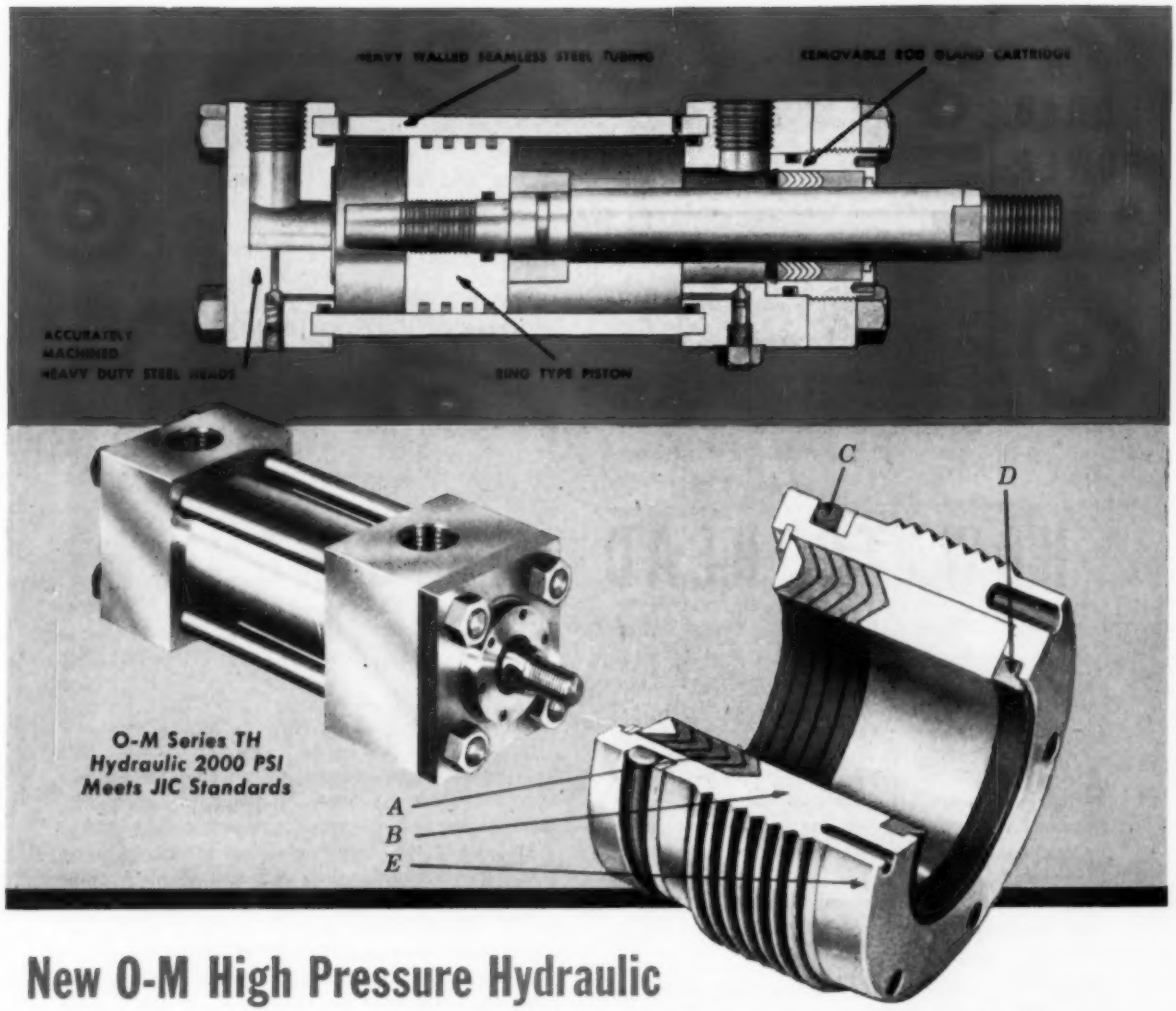


FIG. 2. RIGID and simple, this index mechanism locates the work piece horizontally. A similar index takes care of vertical drill head positioning.

Drill feeds up to 18 ipm with a ¾ inch oil-flute drill have been achieved on steel tube sheets. This high feed rate compares with 2½ ipm maximum feed used with gear head and lead screw designs.

Sheets up to 10 inches thick, varying in diameter from 24 to 67 inches can be drilled with ⅜ to 1½ inch diameter holes. ▼▼▼

FIG. 3. TO HOLD the weight of the 3800 lb drill heads, hydraulics is the answer. Electric controls in the opened panel provide automatic cycling which adds speed to this difficult drilling job.



New O-M High Pressure Hydraulic Cylinder equipped with Removable Rod Gland Cartridge

The O-M-engineered removable Rod Gland Cartridge, exclusive with the O-M Series TH Hydraulic Cylinders, incorporates all the features essential to peak performance and minimum maintenance. It is constructed with a heavy wall steel shell threaded for quick, easy removal, and accurately piloted in rod head to assure perfect alignment. In most applications cartridge can be removed easily without removing mounts or the rod nuts. You simply loosen and remove with a spanner wrench.

A ***Rod Packing*** — Vee type, non-adjustable, self-compensating, rod gland packing provides multiple lip seal with excellent pressure sensitivity and long life.

B ***Rod Bearing*** — Extra long, bronze rod bearing provides large bearing surface located well forward for maximum support of piston rod.

C ***Cartridge "O" Ring Seal*** — With leather back-up washer provides positive seal and acts as friction lock to retain cartridge.

D ***Rod Wiper*** — Homogeneous lip type located well forward to prevent accumulation of dirt in pocket. Metallic scraper (AN approved) available and interchangeable with wiper.

E ***Pilot*** — O.D. of cartridge serves as pilot for cylinders mounted on rod end.

O-M Series TH High Pressure Hydraulic (oil) Cylinders — conservatively rated at 2000 P.S.I. — are available in bore sizes 1½ to 8-inch inclusive. Descriptive drawings of cylinder, mounts, mounting brackets and capacity chart are included in the new O-M Bulletin 105. Mail coupon for your FREE copy today.

ENGINEERING SERVICE — consult an Ortman-Miller representative regarding your hydraulic or pneumatic problems. His broad experience with standard and special cylinder applications is available to you without obligation. Use convenient coupon.

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FLUID POWER CIRCUITS

MACHINE TOOLS

Reading JIC hydraulic circuits still seems to confuse many machine designers and plant maintenance people. Let's face it. To do a proper design job and to efficiently troubleshoot a circuit, understanding JIC symbols is a must. After more than eight years of use, these symbols have proved to be the best "language" for fluid power circuits.

HOW TO READ JIC CIRCUITS

• By Peter Coffaro

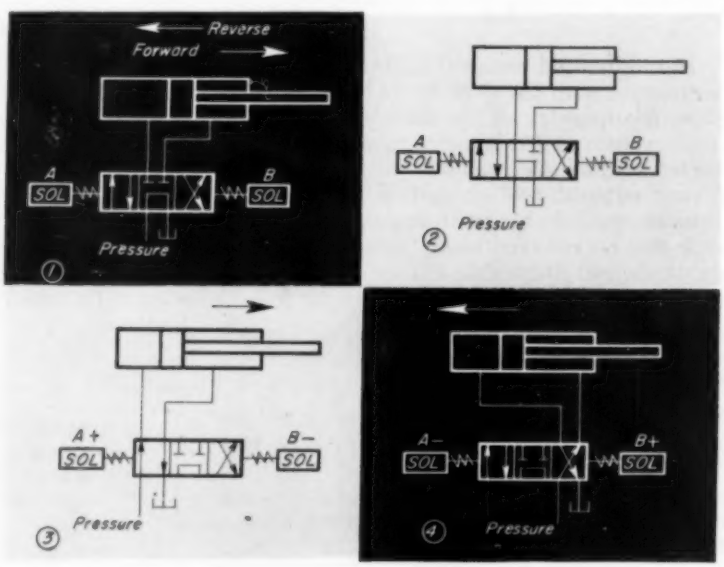
ALL too often when machine tool builders send their customers JIC prints of the machine hydraulic circuit, there is no one in the engineering or maintenance department who fully understands the symbols.

JIC symbols have several distinct advantages over other types of drawings: they are much easier and faster to draw than sections through the valves; they provide a universal language for everyone; there is less chance of error in drawing and reading.

Ordinarily the circuit is shown in neutral position. Figures 1 and 2 show different simple circuits in neutral position. In any case, shifting the valves to the cylinder lines mentally gives a picture of linear piston motion in one or the other direction.

A popular misconception in circuit reading is to trace the lines from the pump on out. On a com-

PETER COFFARO, *Avey Drilling Machine Company, Cincinnati, Ohio.*



FIGS. 1-4. Circuits are usually drawn with all valves shown in neutral position. The JIC symbols clearly show the number of valve positions and the flow of oil through the valve in each position.

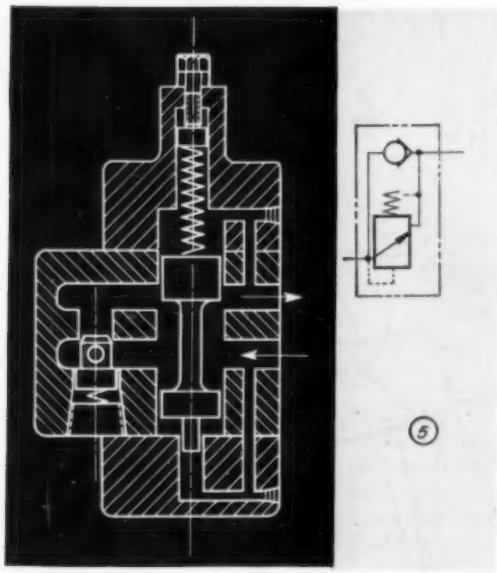


FIG. 5. Comparing the JIC symbol with a sectional drawing of a counterbalance valve shows the advantages of the symbols. Not only is drawing time reduced from about 40 minutes to 5 minutes, clarity is increased.

plicated circuit this can lead to confusion and misinterpretation of the circuit. The more practical place to start is at the work being powered by cylinder or fluid motor.

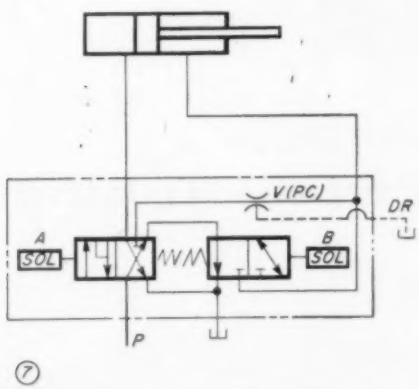
Figure 1 tells the person reading the circuit that the cylinder is stationary. If forward motion is desired, solenoid A must be visualized as moving the valve spool to position shown in Figure 3. For reverse motion, the valve will have to be moved as in Figure 4. This is simple to do mentally.

A typical machine tool slide circuit has rapid advance, feed and rapid return. On the diagram, this would always be shown in one position only, Figure 6. If rapid advance is desired, line 7 has to be a pressure line, and line 6 has to go to tank. Line 6 is connected to line 5 through deceleration valve to line 4 and line 3. Pilot plunger C is shifted by solenoid B to connect line 3 to line 2 and tank. Line 7 at the same time is connected to line 1 and pressure.

Feed is reasoned in this manner: Line 6 is still connected to tank, however, deceleration cam is depressed so that line 5 cannot connect to line 4, but rather has to go through flow control valve to line 4, 3 and to tank.

For rapid return, line 7 must go to tank and line 6 must be pressure. LS-2 sends signal to 4-way valve, deenergizing solenoid B, energizing solenoid A, causing pilot plunger D to shift, connecting line 7 to line 2 and tank. Line 3 is now connected to line 1 and pressure.

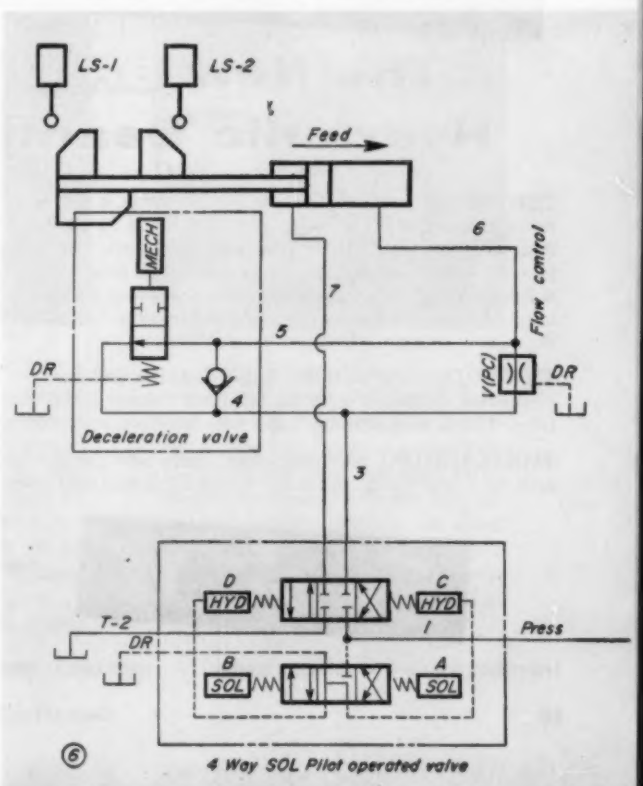
Figure 7 is a little more involved, but if the circuit diagram is traced backward from the cylinder to the pump, this or any other diagram will be "duck soup." ▼▼▼



CYCLE SEQUENCE	SOL A	SOL B
RAPID ADVANCE	+	+
FEED	+	-
RAPID RETURN	-	+
STOP	-	-

FIG. 7. Use of a cycle sequence chart for more complicated circuits makes it simple to visualize the cylinder action which results from valve actuation.

FIG. 6. Forward, reverse and stop action is electrically controlled. Cam actuation of the deceleration valve smoothly changes rapid approach into slow feed.



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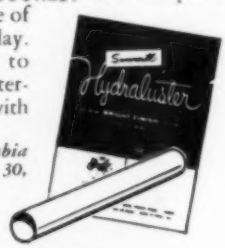

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FLUID POWER MACHINE TOOLS FIXTURES

4 SIMPLE CIRCUITS

. . . improve machining operations at Packard-Clipper

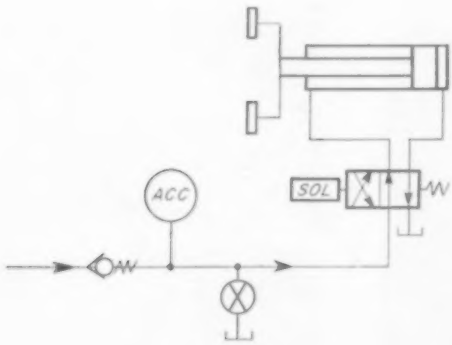
"BECAUSE of the clamp they did the job". Every tool engineer fully appreciates the importance of "a bolt in the right place". Many expensive machines tools with the finest cutters have turned out scrap because of an inadequate loading device, a faulty index, or a flimsy clamp. Automatic production facilities make these fixtures more important than ever. Air and hydraulic power is the answer to many fixture design problems.

A tour through modern machining facilities turns up a number of simple applications of fluid power which are helping to efficiently produce precision parts. Here are four typical applications at Packard-Clipper Division's new Utica, Michigan Engine plant.

1. TWO HYDRAULIC CLAMPING shuttle slide fixtures are on this broach. The broach is used for broaching brake drum pads of the steering knuckle. As each broach operates alternately, each fixture slides in and out and the part is clamped and unclamped in proper sequence by limit switch actuated solenoid valves.

Each fixture is powered by a separate hydraulic circuit having a vane type, 8 gpm pump with relief valve set at 450 psi. Each cylinder is controlled by a 4-way, closed center solenoid controlled-pilot operated valve. The fixture slides 13 inches between load and broach positions in about 3 seconds. Clamping takes less than 1 second. Rigid clamping is easily obtained iwth hydraulically powered clamps.

2. RIGIDITY WAS the reason for the change-over of clamping setup on this New Britain machine which finish bores connecting rods. The old setup, right, used air for the clamps on one side and oil for the clamps on the other side. Compression of the air made it difficult to maintain consistly accurate boring. The new setup which is in construction in the photo on the left has a full hydraulic clamping arrangement. This machine will finish bore four rods at a time.



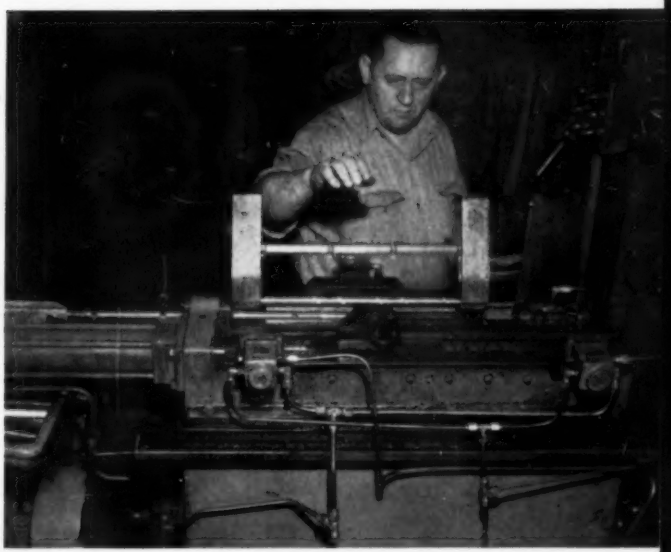
3. HYDRAULICS is used to align engine pistons on this turning and piston ring groove machining operation. The cylinder applies a force against two motor pistons while they are spinning and being chucked. A small accumulator assures pressure on the alignment cylinder.

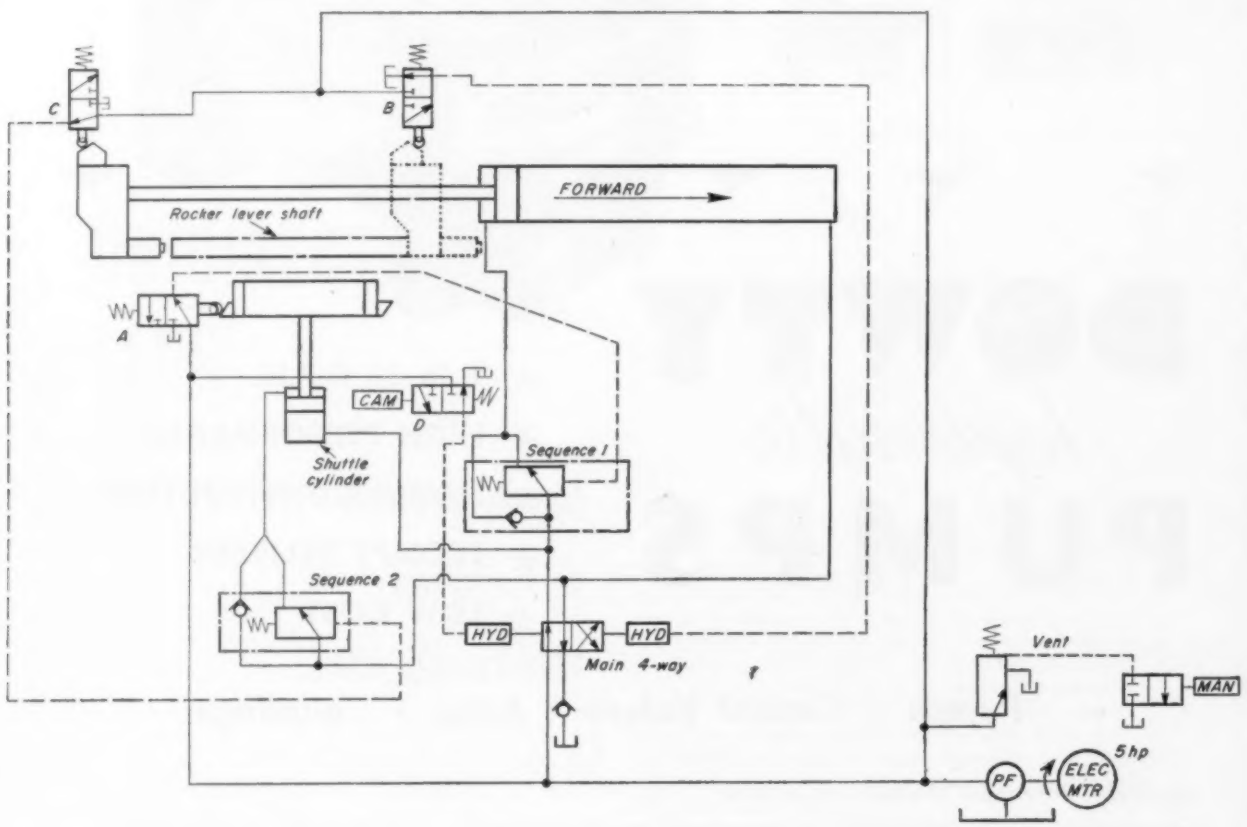
4. BURR REMOVAL from O.D. of V-8 engine rocker lever shaft is done on this hydraulically powered fixture. The shafts are manually loaded into a magazine where they drop into position by force of gravity. A cross-moving hydraulic actuated slide moves them into work position. A second oil actuated shuttle slide then forces them horizontally through a shearing die. The fixture

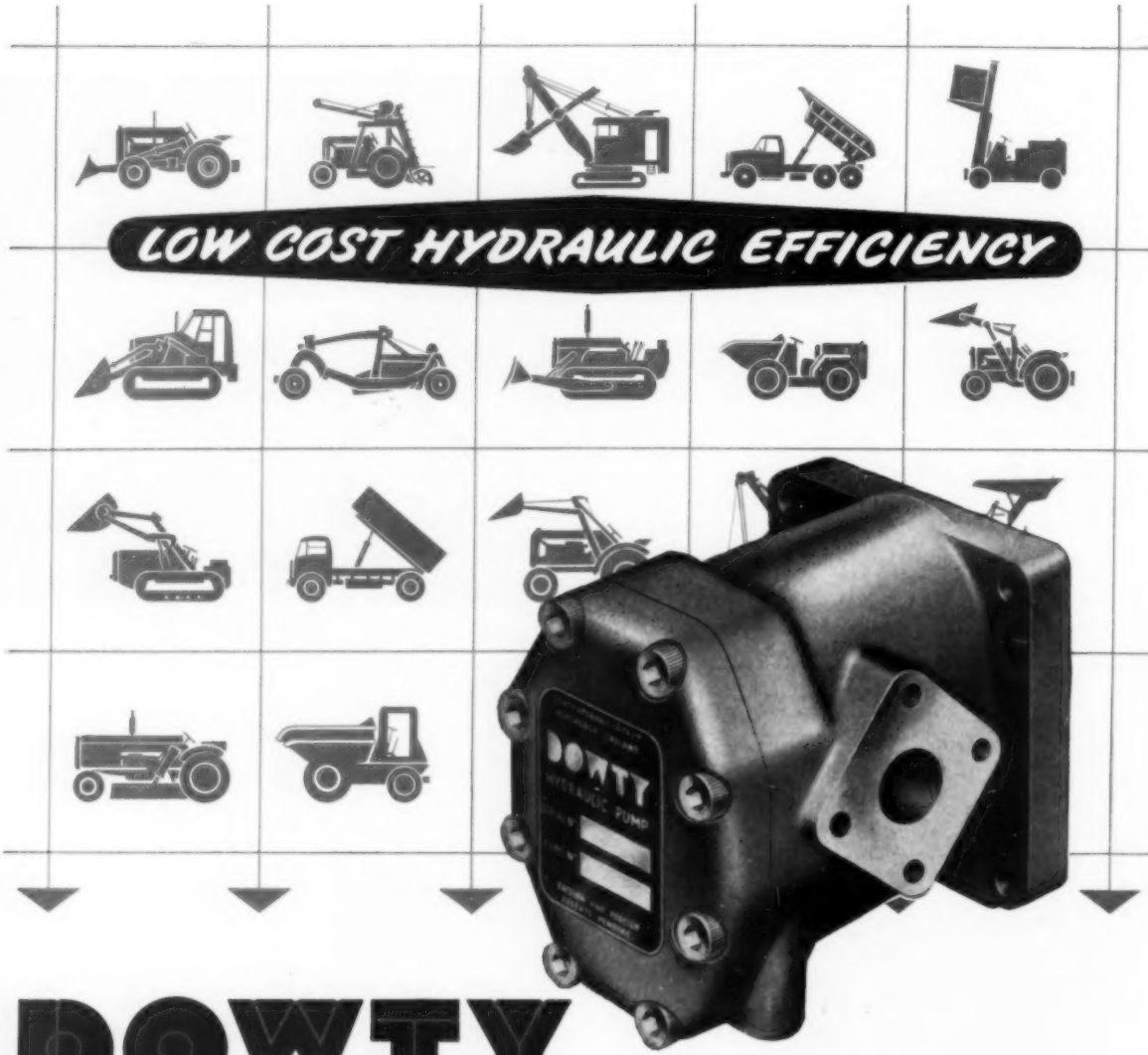
continues to repeat this cycle as long as shafts are in the magazine or until the operator manually shuts the power off.

A full pilot actuated circuit is used. The only electrical control is the pump motor starter. Start and stop of cylinder operation is obtained by manual operation of a 2-way valve which is opened to vent the relief and unload the pump. Closing the vent valve permits oil pressure to build up and direct pump delivery to the cylinders. The work shuttle cylinder moves the work into place and trips pilot valve "A" allowing pressure to open sequence valve 1. Oil now powers the feed cylinder which moves the work through the shearing die.

At completion of the feed travel. Pilot valve B trips to direct oil to shift the main 4-way which causes feed cylinder reversal. When the feed cylinder returns to the start position, pilot valve C trips, allowing pressure to open sequence valve 2. Now, the load cylinder returns and trips pilot valve D to cause reversal of the main 4-way. The load cylinder moves forward, puts the part in place for burring and again trips pilot valve A to initiate the feed stroke of the power cylinder. ▼▼▼







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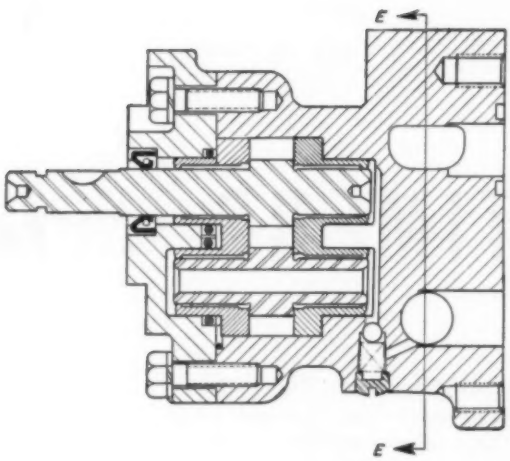
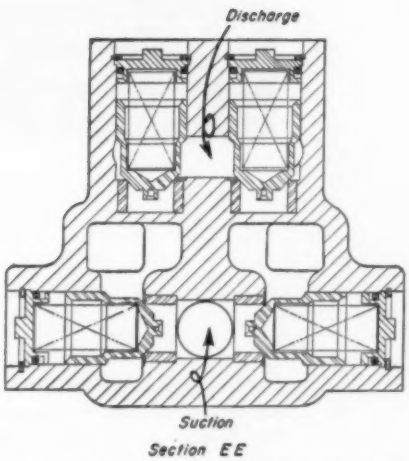
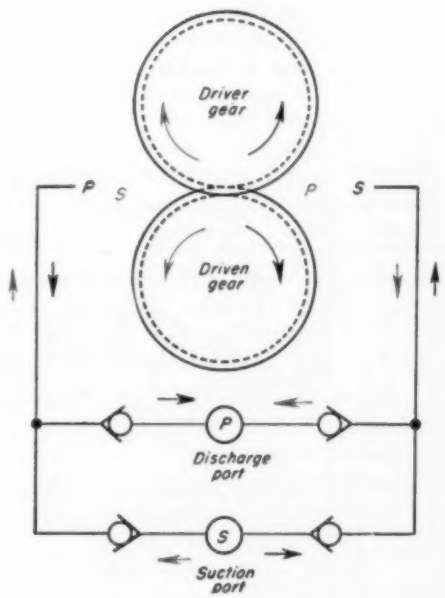




Courtesy Pesco Products Division Borg-Warner Corp.

Discharge and pressure ports remain the same regardless of rotation of the pump drive. This pump design meets the need for hydraulic flow in a single direction on jobs having a dual rotation power source. This reversible pump used on Monarch's new Dyna-Shift lathes is rated at 1000 psi and will deliver 3.6 gpm at 1800 rpm. The pump is a pressure loaded gear design. Check valves are built into the pump housing to maintain the hydraulic flow in and out of the pump in one direction.



UNIDIRECTIONAL FLOW

. . . from a pump rotated in both directions

WHEN The Monarch Machine Tool Company engineers designed the new line of Dyna-Shift lathes, they needed a reversible pump for the hydraulic system. The pump used in these lathes supplies oil for lubrication as well as operation of the headstock speed shifting devices and controls.

An extra pump motor is eliminated on these lathes by driving the pump through "V" belts from the main spindle drive motor. Since some lathe operations require reversal of spindle rotation, the pump gear rotation will also reverse. Use of the reversible pump to keep flow going in one direction makes unnecessary a separate pump drive or complicated gearing to keep pump rotation in one direction regardless of the reversing drive.

The drive motor mounts on a base having vertical movement for adjustment of "V" belts which drive the spindle. Hollow motor base contains pump and oil reservoir. ▼▼▼

APPLIED HYDRAULICS

ELECTRICAL CONTROL ARTICLE

TIMERS ... *for*

Probably no other component contributes more to the automatic operation of equipment than a timer. This device actuates other electrical components to start and stop certain phases of the machine cycle, and it does this at exactly the right moment. Once the machine cycle is determined, the timer can be set to control the machine, usually with greater accuracy and dependability than is possible manually or by other means.

TIMER SELECTION

Type	*Operation*	*Range*	*Accuracy*	*Remarks*
Motor	Synchronous motor drives cam shaft through gear train. Reset type has solenoid-actuated clutch and tripping mechanism.	1 sec. to 360 hrs. for repeat cycle timers. 1/20 sec. to 100 hrs. for reset timers.	.1% for reset timers. 1% of cycle time for repeat cycle timers.	Complete cycle of repeat cycle type can only be changed by replacing gearing. D-c motor timer is used for remote control of timed period.
Electronic	Discharge of capacitor through a resistor permits thyratron grid bias to increase until tube conducts to actuate relay.	.025 sec. to 3 min.	Approximately .5% depending on type of relay and timing range.	Voltage regulator may be incorporated in timer to compensate for unstable supply voltage. Reset time ranges from .05 to 1 second.
Pneumatic	Escape of air through valve allows diaphragm to actuate contacts.	.2 sec. to 3 min	10% of mean timing period.	Timers for aircraft applications must be hermetically sealed. Timers can be fitted with air filters for dusty atmospheres.
Dashpot	Solenoid exerts force on piston which is retarded by flow of oil through integral orifices.	2 to 30 sec.	15%	Minimum reset time is 1/2 second. Timing is function of oil viscosity. Timing adjustments can be made by changing orifice size.

• By Allan E. Morris
Associate Editor APPLIED HYDRAULICS

fluid power control

OF THE many basic types of timers available for industrial and commercial applications, four types are most commonly used for control of fluid powered equipment. These are motor, electronic, pneumatic, and dashpot designs. Selecting the right timer for the job requires consideration of such factors as timing cycle, accuracy, load, and cost.

Operation of the equipment which the timer is to control is the first consideration in selecting a timer:

- How long is the timed delay?
- Must it be variable for flexibility of the machine?
- Is the machine to run continuously, repeating the same cycle, or must it stop at the end of the cycle and be re-actuated by a pushbutton?
- How many circuits must the timer control and when must they be open or closed?

These are the kinds of questions the designer must ask in the preliminary stages of applying a timer. Along with the timing cycle, the required accuracy of the timer must be considered. This includes the exactness to which the timer can be set initially, as well as its ability to repeat the set timing period. A trial and error method may be required to determine the correct time period and to set the timer exactly. Depending on the type of timer, the accuracy can be affected by ambient temperature—especially low temperatures; coil temperature which depends on duty cycle; line voltage; and the length of time between operations.

The two general classifications of timers are repeat-cycle timers and reset timers. Once the repeat-cycle timer is actuated, it continues to program the equipment through the same cycle until deactuated. The reset timer stops after one cycle is completed and must be actuated to begin each new cycle.

The time required for the timer to reset back to its initial position may be an important selection factor. Some machines may require that the timer reset instantaneously, while in others the requirements may permit a longer reset time or may require that the timer remain in a "timed out" condition before it is actuated to reset.

Because timers actuate other control components —usually relays—they are not required to carry heavy loads. Contact rating for one type of oil dashpot timer is 5 amperes on 110 volts ac. For the pneumatic, motor, and electronic timers, common contact rating is 10 amperes at 110 volts ac.

Of course, cost is a factor in timer selection and is affected by quality, type, and service requirement of the unit. Frequently the timer plays so vital a role in control of automatic equipment that quality and dependability cannot be stressed too highly. The duty cycle will determine how rugged a unit is required. Other factors affecting this are mounting requirements, amount of vibration the timer must withstand, and its exposure to damage.

The power supply available for operation of the timer may determine the type that can be used. Frequency is especially important where synchronous motor types are used, because frequency of the power source determines the speed of the motor and consequently the calibration of the timer.

MOTOR TIMERS . . . of the repeat-cycle type consist essentially of a motor-driven shaft on which are mounted cams that actuate limit switches as the shaft rotates. Shaft speeds from 50 rpm to 1 revolution in 360 hours are possible by using the proper gear train between the motor and the shaft. The number of circuits which can be controlled by this type of timer can be increased by adding cams to the shaft and is limited only by space and the motor torque. Standard units with 12 contacts are available, though it is seldom that more than 4 or 5 are required. The on-off time of each controlled circuit is individually adjustable by using the proper cam, and this permits great flexibility in controlling circuits in relation to each other. The complete cycle of an a-c timer is not easily changed, however, requiring a change of the gear ratio between the driving motor and the cam shaft. Cycle times from 1/20 second to 100 hours are available.

When the timing period is to be set from a remote point, a d-c motor timer may be used. In this unit, speed is proportional to voltage which can be easily controlled by a potentiometer. Timing ranges from 1 second to several hours can be obtained in this manner. The accuracy of the timed period will, of course, depend on the accuracy of the voltage supply.

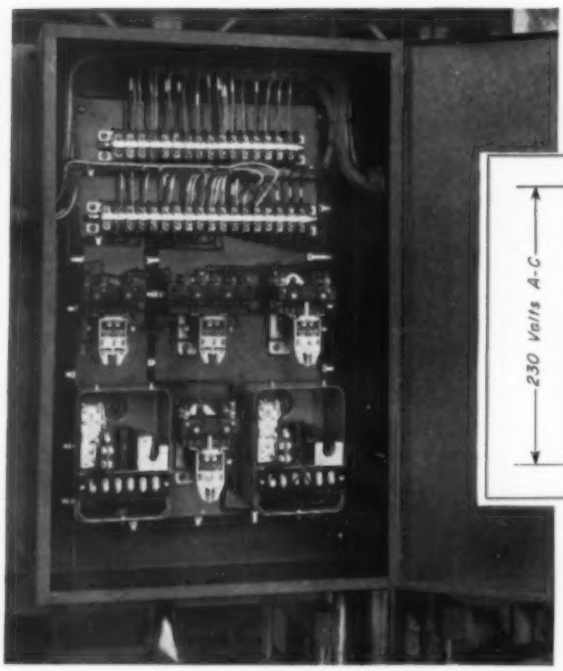
The motor-driven, reset timer consists of a syn-

chronous motor driving a tripping mechanism through a solenoid actuated clutch. When the solenoid is energized, the clutch is engaged and certain contacts are actuated depending on the arrangement of the timer. The motor may be energized through a set of these contacts or may be energized through external controls. When the time setting is reached, contacts are actuated or deactuated by the tripping mechanism, and when the solenoid is de-energized all contacts return to their original position. Operation of the reset timer can be divided into three phases designated "reset", "timing", and "timed out". The timer solenoid causes the contacts to open or close in going from reset to timing, and the timer motor and tripping mechanism cause the contacts to open or close in going from timing to timed out position. In reset condition neither the solenoid nor the motor are energized. During timing both the solenoid and motor are energized. During timed out phase only the solenoid is energized.

Some motor timers have two setting knobs. The ON knob is adjusted for elapsed time from initiation of timing until the contacts close. The OFF knob determines the total elapsed time from the initiation of timing until the contacts reopen.

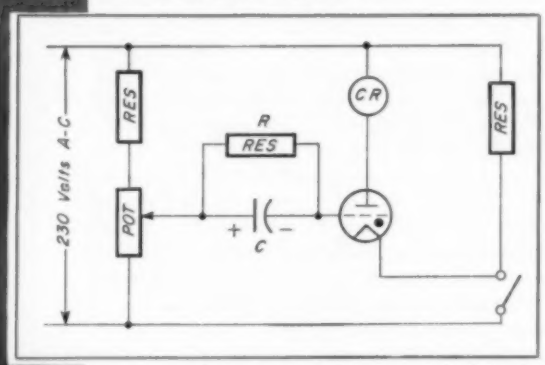
In one type of reset timer three contacts are controlled by the solenoid as well as the motor. When a momentary-contact actuating device such as a pushbutton or limit switch energizes the timer, the solenoid and motor are energized and lock-in to power through one of the timer contacts. Thus the timer goes from reset to timing phase. At the end of the timed period, the tripping mechanism opens the two load contacts and the holding contact. This de-energizes the motor and solenoid and allows the clutch to disengage. In this case the timed out phase is bypassed.

ELECTRONIC TIMERS . . . depend on the rate of discharge of a capacitor through a resistor. A common arrangement is to connect the negative side of the capacitor to the grid of a thyratron. The tube acts as an amplifier and has a small relay in its plate circuit. The thyratron is a gas triode which does not conduct unless its grid voltage is more positive than



Courtesy General Electric Co.

ELECTRONIC TIMER . . .



. . . shown mounted in panel at left, depend on time of capacitor discharge through a resistor. In diagram above, when switch is open, capacitor charges with polarity shown. Every other half cycle, tube cathode is negative with respect to grid and charging path is from cathode to grid to capacitor. Capacitor discharge through resistor R is replaced by the charging current. Thus negative charge is placed on thyratron grid to prevent tube from conducting. When switch is closed at beginning of timed period, capacitor discharges until tube voltage is positive enough for tube to conduct and actuate relay CR ending the timed period. If the initiating switch is opened before the timing interval has been completed, the relay will be reset for another complete timing interval.

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a critical value which is usually about minus 2 volts. As the capacitor discharges, the negative grid voltage becomes more positive until such time as the tube conducts and actuates the relay.

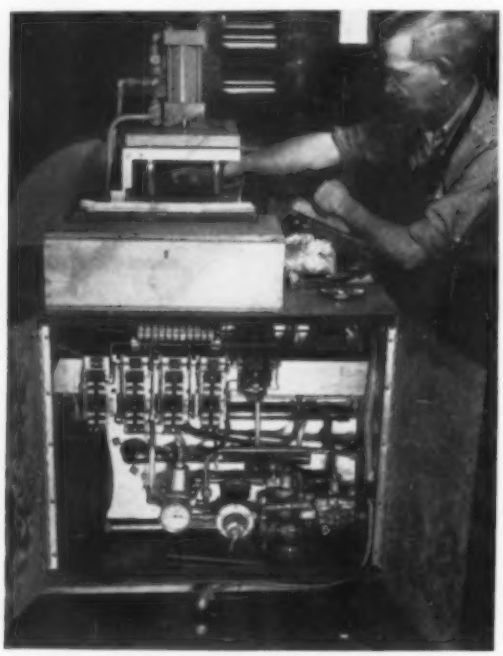
The time period of an electronic timer can be changed by changing the capacitor or the resistor through which the capacitor discharges. This latter adjustment is easily done with a rheostat which can be located remotely. The range of electronic timers is from .025 second to 3 minutes. This type of unit is particularly adaptable for highly repetitive operations and has an accuracy of about .5% depending on the relay used. Errors due to variations in the power supply may be compensated by special circuits and voltage regulators designed into the timer.

A warm-up time of 10 to 30 seconds may be required to heat the tube filament, although newly developed cold cathode tubes have no filament and thus eliminate this warm-up time. A short time may also be required for the capacitor to recharge for another timing cycle, though electronic timers are also available for instantaneous recycling.

PNEUMATIC RELAYS . . . consist of a solenoid, snap switch, and bellows or diaphragm. When the solenoid is actuated, it exerts force against the diaphragm. An adjustable needle valve permits air to escape from the diaphragm at a controlled rate regulating the time setting.

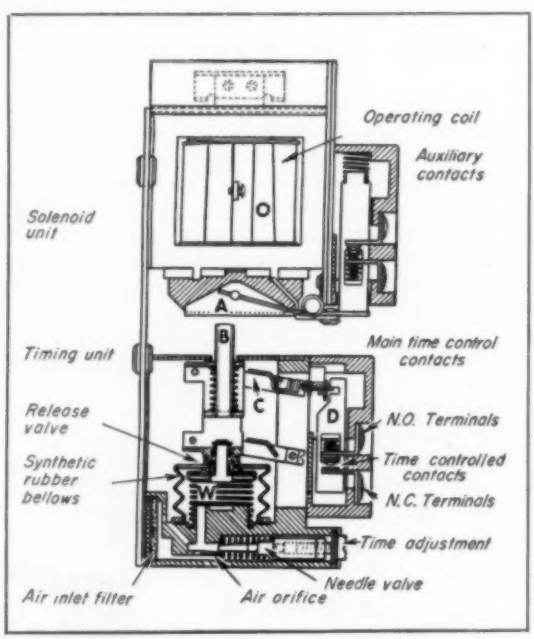
Various modes of operation are available in standard models. The time delay may begin when the coil is energized, when the coil is de-energized, or when the coil is both energized and de-energized. In another type two time delay periods are provided and other combinations are available.

Normal variations in voltage, ambient temperatures, and atmospheric pressure have little effect on pneumatic timer accuracy which is about 10% of the mean timing period. Pneumatic timers maintain the setting from −65 to +165 degrees F. Large changes in altitude as encountered in aircraft applications will change the time delay for a given setting. Consequently for aircraft use, hermetically sealed units are used. Standard units can be set for time delays from .2 seconds to 3 minutes and



. . . depends on adjustment of needle valve for time period. Energizing coil *O* raises solenoid plunger *A* and allows spring-loaded bellows to push up rod *B*. As rod *B* moves up, it causes off-center link mechanism C to move the end of the snap action mechanism upward, raising D to throw the switch. When the solenoid is de-energized, plunger A drops to reset the timer. The setting of the needle valve determines the time interval by regulating air entry into the bellows.

PNEUMATIC TIMER . . .



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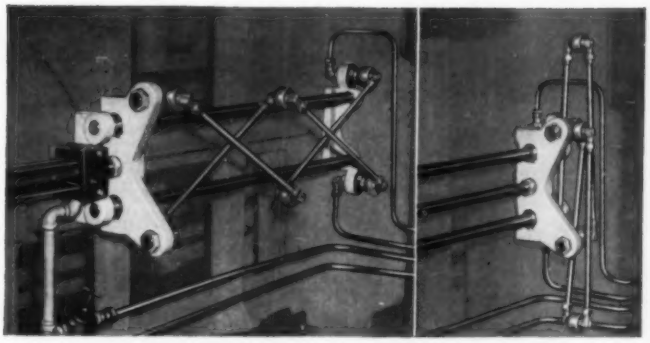

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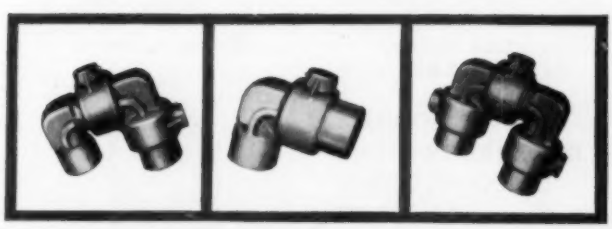

Typical Chiksan Swivel Joints

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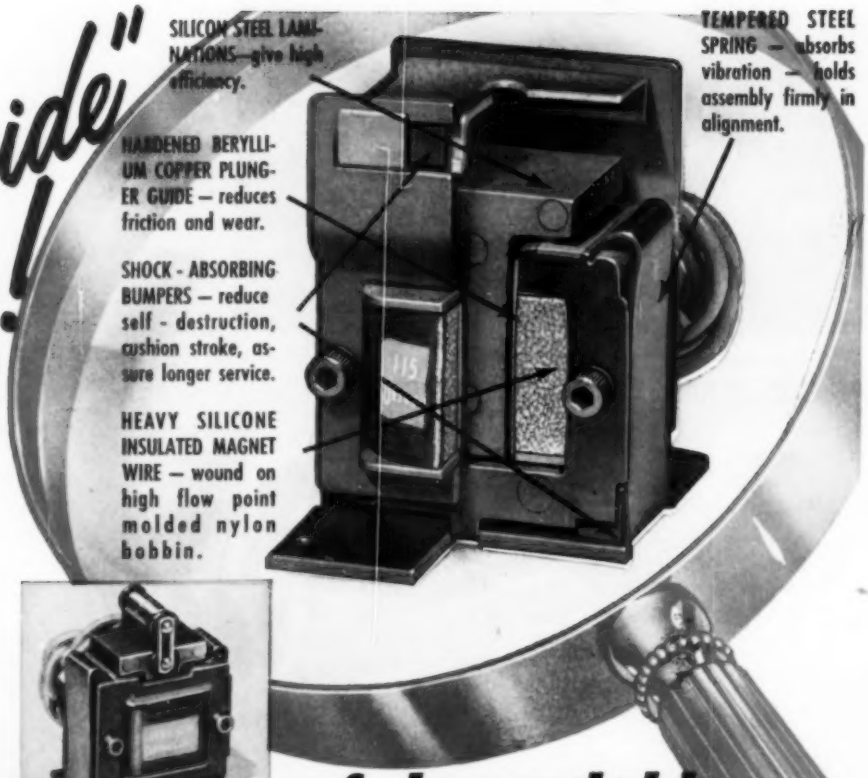
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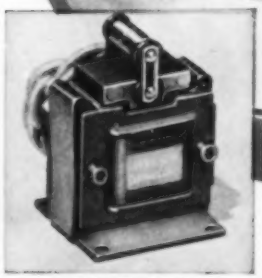

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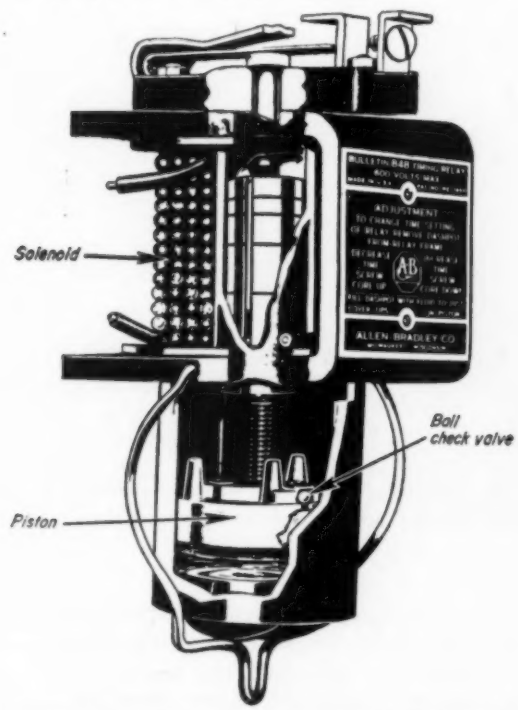
TIMERS FOR FLUID POWER CONTROL

reset time is about .075 seconds. The timers may be provided with an indicator which permits approximate setting of the timer. Many pneumatic timers are equipped with an air intake filter, so that they can be used in dusty atmospheres.

DASHPOT TIMERS . . . contain a magnetic relay which is retarded by a plunger operating in an oil cylinder. When the coil is energized, the plunger and piston move at a rate controlled by openings in the piston. When a certain point in the travel is reached, a bypass permits rapid completion of the stroke and final operation of the electrical contacts. The timing adjustments are made by changing the size of the openings in the piston or by changing the initial position of the plunger and piston by screwing the assembly up or down.



DASHPOT TIMER **has openings in piston to permit adjusting timing period. Dashpot assembly is removed to adjust the openings. Ball check valves in piston permit resetting of timer in .5 second after coil is de-energized.**

Courtesy Allen-Bradley Co.

Dashpot timers combine simplicity, dependability, and low cost. They are used when reliability is more important than accuracy. When some dashpot timers are de-energized, considerable time must be allowed for the piston to return to its initial position. If sufficient time is not allowed for this resetting, timing is erratic. This is overcome in some designs by providing two ball check valves in the piston. When the piston begins its downward travel, these check valves open to permit rapid resetting.

Timing periods range from 2 to 30 seconds with a reset time of .5 seconds on models incorporating check valves in the piston. Accuracy is 15% of the time setting. The timing depends on viscosity of the oil which is a function of temperature. To reduce effects of temperature variation on time delay, silicone fluids are used in the dashpot. This provides a minimum variation in timing at temperatures as low as —10 degrees F, and even at —25 degrees F the increase in time for a given setting is not great. ▼▼▼

PRESSURE CONTROL FOR COUNTERSINKING

Concluded from page 76

noid C permits pressure on the spindle to drop to the low setting of the relief valve R-3 so that the cleaning of the hole is done with a low thrust on the cutter. When the timer times out, it energizes relay 3-CR which in turn de-energizes solenoids A and C. The spindle then retracts with a force determined by R-2 while the foot continues to hold the work. As soon as the cutting tool is out of the finished hole, limit switch 2-LS is tripped to de-energize relay 3-CR and solenoid B, so that the foot retracts.

To ensure that the tool enters the work at a 90-degree angle with the work, two normally-open limit switches are actuated by fingers next to the anvil on which the work rests. These limit switches are wired in series with the starting foot switch, so that if the work is not in the proper position to actuate both limit switches, the machine cannot be started.

The depth of countersinking is maintained uniform regardless of the thickness of the work by stopping the spindle against a mechanical stop on the foot. Thus the upper side of the work is used for a reference and the countersink hole is always the same depth. However this means that at the end of the cutting stroke, force on the spindle would be added to the force on the foot and if this force were not reduced at this time, the work would be marred. To solve this problem, solenoid C is energized when the spindle reaches the end of its stroke, and pressure on the spindle drops to the setting of relief valve R-3.

The redesigned machine has the oil tank built into the frame, so that it can be moved as a unit, and maintains the compactness of the former machine. The hydraulic system operates at 350 psi which minimizes leakage and maintenance. Unskilled operators can perform precision work, because all the necessary accuracy is incorporated in the machine itself, and the functions of the machine operator are reduced to loading, unloading, and starting the machine. ▼▼▼

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A Progress Report . . .

HYDRAULIC FLUIDS FOR 400 F

- By Harry M. Schiefer and Bernard Rubin

- Pump design will be affected by lower fluid lubricity
- Low oxygen in a closed system will improve fluid life
- Water contamination must be small
- Venting of volatiles and fire prevention precautions may be necessary
- There's a need for improved seals, pumps and other components

DEVELOPMENT of newer weapon systems, which were initiated about 1950, has led to the introduction of tactical and strategic aircraft in the field with Mach 1 to Mach 2 capabilities for extended periods of time. The normal consequence of this progress from subsonic to transonic speeds has been an increase in the overall ambient and operating temperature of the aircraft and its subsystems. It is perhaps needless to add that the upward spiral of the temperature curves, as we enter the supersonic era, is logarithmic.

The aircraft industry and military service groups associated with and responsible for hydraulic system and component design have in the last two years recognized three categories of hydraulic systems specified by temperature ranges as follows:

Type I	—65 to 160 F (open system)
Type II	—65 to 275 F (pressurized system)
Type III	—65 to 400 F (pressurized system)

The hydraulic fluids for the Type III system will be discussed extensively in this article. Specification MIL-0-5606 is being used for the Type I and Type II categories.

Approximately 5 years ago the USAF initiated research and development work in high temperature hydraulic fluids. At that time a contract was negotiated between the California Research Corporation and the USAF to investigate various classes of compounds toward an ultimate goal of a stable —65 to 400F hydraulic fluid. The fluid viscosity requirements were given at 2500 cs (centistokes) maximum at —65F and approximately 4.0 cs mini-

HARRY M. SCHIEFER, *1st Lt, USAF,* BERNARD RUBIN, *Materials Laboratory, WADC, Dayton, Ohio.*

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mum at 400 F. Many of the fluid requirements that were originally established were, to some extent, ambiguous, and represented the thinking of pump and hydraulic system component manufacturers and governmental agencies at that time. Experience with MIL-O-5606 fluid was used as a guide for proposed requirements.

Consequently, some of the original requirements have been changed and it is likely that other changes will be made, some more stringent and others more lenient, as more experience is gained from mock-up tests and actual service experience.

After a thorough study of various classes of compounds it was decided that the ortho-silicate esters were the most logical class to investigate further for the development of a hydraulic fluid for the —65 to 400F range. In this class the following groups of compounds were studied; ortho-silicates, mixed ortho-silicates, disiloxanes, trisiloxanes, and polysiloxanes.

It was from the second group, disiloxanes, that the first experimental high temperature hydraulic fluid was developed. This material was coded by the Materials Laboratory of WADC as MLO 8200. The fluid blend consisted of hexa (2-ethyl butoxy) disiloxane, as a base fluid, a polymeric silicone as a viscosity index improver and several additives employed as anti-oxidation and anti-corrosion inhibitors.

Other fluids, besides MLO 8200, have been developed concurrently with the contract with California Research Corporation, and some more recently. These fluids include the following: OS-45 and OS-45-1 of Monsanto Chemical Company; 71852-B, 72073-C, and 72173-C of Hollingshead Chemical Corporation; and 85/15 fluid (MLO 54-645) blended at WADC. Currently a similar formula of 85/15 is available from Oronite Chemical Company.

WHAT ARE MIL-H-8446 TYPE FLUIDS?

Recently a specification has been released which covers the requirements for a —65 to 400F hydraulic fluid and is designated as MIL-H-8446 (USAF). The requirements of the specification are outlined in Table I with data on some of the more promising silicate ester fluids shown in Table II.

The 400F viscosity is not definitely set in the specification but mock-up test experience has indicated that a viscosity as low as 1.5 to 2.0 cs will not seriously effect the operation of most components.

Some of the formulations given in Table II have looked promising for the 400 F application. It must be remembered that all of these fluids have as their basic constituent, silicate esters, and as such, they are quite similar in physical and chemical properties to the MLO 8200 fluid. This means that most of the advantages and disadvantages of the MLO 8200 fluid are carried over into these fluids. The basic problem with the MLO 8200 fluid is clearly shown in this table—low rubber swell of an unplasticized standard "R" stock (neoprene) elastomer. This would result in shrinkage of "O" rings and packings made from a plasticized neoprene stock with resultant excessive leakage from components. Mock-up tests have confirmed this assumption and consequently, MLO 8200 is not considered desirable

TABLE I

Viscosity	
—65 F	2.5 cs min.
400 F	2500 cs max.
Pour Point	Below —75 F
Vapor Pressure at 400 F	5 mm Hg max.
Spontaneous Ignition Temperature	700 F min.
Neutralization Number	0.2 max.
Rubber Swell, Standard "R" Stock	25 ± 5%
Foaming at 200 F	
Total Volume Oil and Foam	600 ml max.
Collapse Time	600 sec max.
Low Temperature Stability	No gell or solidification
Oxidation-Corrosion at 400 F	
Weight Loss of Metals—	
Copper	± 0.4 mg/cm^2
Aluminum	± 0.2 mg/cm^2
Viscosity Change of Oil at 210 F	± 20%
Appearance of Metal after Test	No pitting or corrosion
Neutralization Number Change	0.5 max.
Oil Appearance	Clear
Hydrolytic Stability at 200 F	
Copper—Weight Change	0.5 mg/cm^2 max
Appearance	No pitting
Acid Number—Oil Layer Change	0.5 max.
Water Layer	0.5 max.
Viscosity Change of Oil at 210 F	± 20%
Insolubles	0.5 % max.

Specification MIL-H-8446 (USAF) High Temperature Hydraulic Fluid.

TABLE II

TEST	MLO 8200	A	B	C	D*
Viscosity, cs					
—65 F	2600	2230	2220	2600	2523
400 F	4.0	1.20	2.7	2.5	3.0
Pour Point, F	Below —75	Below —75	Below —75	Below —75	Below —75
Vapor Pressure at 400 F, mm Hg	1.2	2.1		2.8	
Spontaneous Ignition Temp. F	815	700	815	770	836
Neutralization Number	0.01	0.02	0.02	0.0	
Rubber Swell	6	14	15	23	18
Foaming, 200 F					
Total Volume, ml	590	230	610	600	540**
Collapse Time, sec	400	61	480	300	580**
Low Temperature Stability	Good	Good	Good	Good	Good
Oxidation-Corrosion at 400 F					
Corrosion Resistance	Good	Good	Fair	Good	Good
Oxidation Resistance	Good	Marginal	Fair	Fair	Good
Hydrolytic Stability at 200 F	Good	Good	Good	Good	Good

*Data from Company furnishing fluid.
**Room Temperature Data.

MIL-H-9446 properties of five silicate fluids.

for the Type III system. Addition of small amounts of a swelling agent (up to 15% of a diester) results in a fluid adequate in rubber swell and other physical properties.

The fluids coded A through D represent products supplied by commercial sources and show in every instance one or more fair or marginal properties. The promise of these fluids, despite these few questionable physical properties, was sufficient to warrant considerable additional laboratory study and mock up evaluation. The spontaneous ignition temperatures, Figure 1, indicate that the initial values obtained at atmospheric pressure fall sharply to 470-510F at injection pressures above 750 psig. These data were obtained in a glass apparatus but the effects of metals will be studied in the future.

Several fluids are presently undergoing qualification testing under Specification MIL-H-8446. It is advisable to point out that the data in Table II may not be the exact properties of the fluids undergoing qualification testing, since this data represents an accumulation of information on the development fluids collected over a period of time. Also, some of the requirements of the specification may be subject to change. Therefore, no conclusions should be drawn at present as to which specific fluids will or will not qualify under the specifications.

EFFECT OF WATER ON SILICATE ESTER FLUIDS

Although all of the fluids mentioned pass the requirements of the hydrolytic stability test of MIL-H-8446 (USAF), nevertheless the stability of the presently available silicate ester fluids in contact with free water, in general, is rather questionable, especially at high temperature. Various types of tests have indicated that the stability towards hydrolysis varies over a temperature range from ambient to 400F.

To get some data of the hydrolytic stability of the presently available silicate fluids, an extensive program both at room and high temperature, has been carried out at WADC. Data has been collected on the magnitude of the changes occurring under room storage conditions and in high pressure bomb tests at 400F with added free water.

This data indicates that a difference in storage hydrolytic stability exists between the four fluids after 26 weeks. Fluid B possesses the poorest stability with fluids MLO 8200 and C standing up the best. However, storage of two of these fluids for a year's period in original containers without water contamination showed no evidence of fluid damage.

It is noted from the series of tests at 400F, that at all water concentrations above 0.5% the fluid property changes increased markedly with increases of water concentrations, with particular emphasis upon amount of solids formed. This series of tests point out the importance of keeping free water contamination to a minimum. Another series

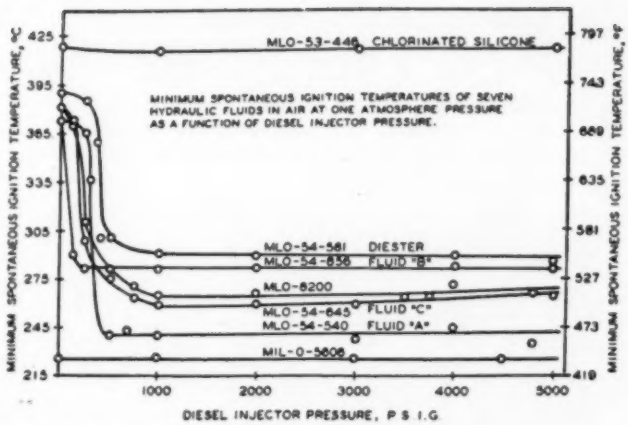

FIG. 1. Spontaneous ignition temperatures of seven high temperature hydraulic fluids.

of tests have shown that, for all four silicate fluids tested, the threshold of hydrolysis (rapid increase in rate of hydrolysis reaction) occurred in excess of 200 hours for 0.5 weight percent water but decreased to approximately four hours for all concentrations above one-half percent.

In addition to the laboratory bench tests which have been conducted, full scale mock up hydraulic system tests were conducted by the Aircraft Laboratory of WADC. In the particular tests performed, for which results are given in Table III, 2% free water was added to the hydraulic fluid and the oil-water mixture was pumped in a closed system at 210F until either pump cavitation or a high pres-

TABLE III

Fluid	% H_2O	Failure Time (Hrs)	% Viscosity Change at 100°F	% Flash Point Change
MLO 8200	2	80	—39.2	—43
Fluid A	2	30.5	—20.8	—36.8
Fluid C	2	93	—31.4	—38

Physical property changes of fluids after mock up hydrolytic stability tests.

sure drop occurred across the filters. Physical property measurements after the tests showed that the viscosity for all these fluids decreased due to the fragmentation of the viscosity index improver or the diluting effect of the alcohol formed during hydrolysis. The drop in flash point was undoubtedly due to the formation of alcohols. This series of tests again shows a slight advantage of fluid C and MLO 8200 over Fluid A.

RESULTS OF MOCK-UP TESTS

Pump mock up tests are being conducted with the silicate fluids at WADC. The pump tests have been conducted at 400F to evaluate mainly the life of the pump and elastomer but at the same time

observe changes in fluid properties. Fluid A was first investigated and tests are now continuing with Fluid C. The results of the pump tests are summarized in Table IV.

At the end of 20.5 hours at 400F and 23 hours

TABLE IV

Test	Total Time of Test Hrs	Time of Fluid at 400 F. hrs	Trouble Exoerienced		Pump
			Seals & Gaskets	Pump	
1	8.6	2.6	OK	Piston Seizure	A
2	2.5	1.5	Leakage		B
3	20.5	19.5	Leakage		A
4	6.75	6.5	Leakage	Thrust bearing race chipped	B
5	16.2	14.0	Leakage	Excessive pressure drop across filter, and thrust bearing failure.	B

400 F Pump tests with fluid A. While these tests were primarily to evaluate pump and elastomer life, changes in fluid properties were also recorded.

total test time, Fluid A had decreased in viscosity approximately 25% at 210F whereas the flash point dropped from 365 to 310F. As shown in Table V, most of the failures that occurred during the pump tests were seal failures with secondary failures due to clearances or temperature differentials. As to date, no failure has been specifically caused by poor lubricity. Although wear has occurred in some tests, it has usually been caused by improper design of the pump for these high temperatures. Every time one of these pumps fails in a test, the pump is sent back to the manufacturer for modification with specific details as to what happened to the pump during the test. It is the belief of the Power Plant Laboratory at WADC and the pump manufacturers at this time, that if the seal problem could be solved, the design problems such as tolerances would rapidly be resolved. Therefore, the major industrial effort at the present time is pointed towards overcoming the seal malfunctions.

Mock up and packing cycling tests have been performed at 300F, 350F, and 400F using MLO 8200 fluid whereas Fluid A was tested only at 400 F. Some property changes of the fluids after the cycling tests are shown in Table V.

TABLE V

Fluids	Test Temp. F	No. of cycles at Test Temp.	No. of hrs at Test Temp.	Vis. at 210 F	Flash Pt. F	Neut. No.
MLO 8200	350	0	0	11.6	415	0.01
MLO 8200	350	46,172	33.3	8.3	245	0.18
MLO 8200	400	0	0	10.2	410	0.01
MLO 8200	400	42,883	27.6	7.8	415	0.23
MLO 8200	400	133,271	97.4	7.7	420	0.12
Fluid A	400	0	0	3.9	360	0.25
Fluid A	400	135,001	100	3.0	270	0.45

Physical property changes of fluids after mock up cycling tests.

Physical properties of both MLO 8200 and Fluid A have changed somewhat after the cycling tests showing some degradation of the fluid. The acidity of the fluids after the tests were still within specification limits, but the flash points were very low and can be accounted for by a very small amount of alcohol present as a result of fluid degradation.

In the test with MLO 8200 at 400F, the mock up cycling system was modified after 27 hrs. and 36 minutes of operation in that a piston driven by MIL-0-5606 fluid was substituted in place of a pump due to the lack of high temperature pumps at the time. Some new MLO 8200 fluid was added at that time which accounted for the rise in flash point.

Operation of the high temperature pumps when MLO 8200 was tested was erratic but the operational life of the pumps has improved. Mock up cycling tests are now under way with Fluid C.

Some of the conclusions that can be drawn from the mock up cycling tests are:

Material

1. Fluid A at 400 F and 3000 psi systems has a tendency to leave deposits on steel parts.
2. Fluid A has poor thin-film characteristics due to rapid film evaporation, complicating the operation of hydraulic cylinder actuators because of rod seal failures.
3. O-rings of neoprene WRT compound and spiral teflon backup rings are still a problem when used for dynamic seals.
4. O-rings of neoprene WRT type hardened and cracked after the test with MLO 8200.
5. Spiral teflon backup rings and O-rings of neoprene WRT are suitable for use at 400 F as static seals.

Design

7. High temperature pumps still need improvement.
8. Filtered suction lines increase the life of pumps.
9. Close control of clearances prolong the life of dynamic seals.
10. Principal difficulties in high temperature pumps were packing failures and thermal differentials causing binding and wear of moving parts.
11. Study of metallic dynamic seals for use in hydraulic systems is needed.
12. Cadmium plating should not be used for hydraulic systems at 400 F.

Reports from representatives of industrial companies who have tested the silicate fluids in high temperature pumps and mock up systems, have indicated that successful operaion has been obtained for various periods of time up to temperatures of 550F. The main difficulty reported again was seal failures.

EFFECT OF SILICATE ESTER FLUIDS ON OTHER AIRCRAFT MATERIALS

Perhaps the single most pressing problem in the development of high temperature hydraulic components for use with silicate fluids has been the

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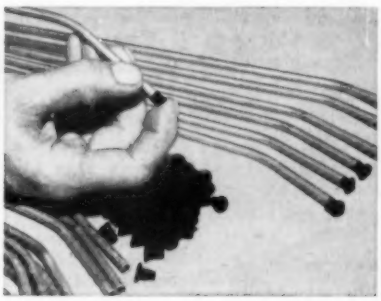

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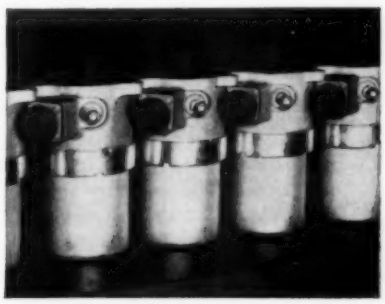

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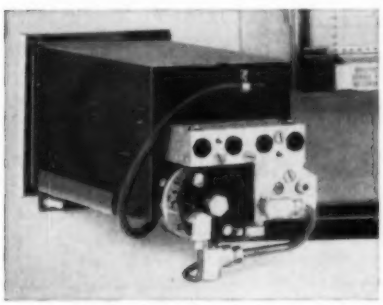
CaPlugs protect electrical connector fittings and armature shaft extensions of these electric motor assemblies. Here's sure, safe protection that's adaptable to all types of products and parts. (Photograph courtesy Pesco Products Division, Borg-Warner Corporation)



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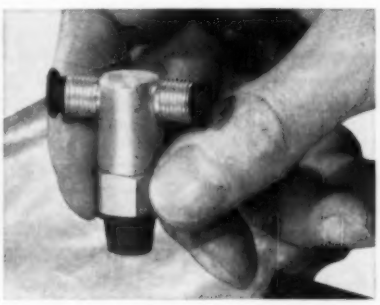

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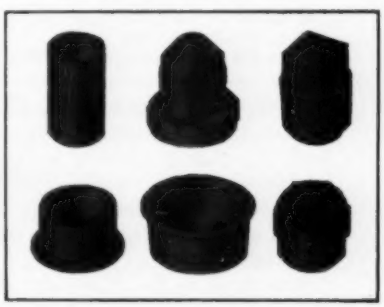
On this Alemite Accumatic Valve, colorful red CaPlugs add zestful eye appeal. Says Stewart-Warner Corp., "CaPlugs help impress the customer with the steps that have been taken to protect the equipment and convince him of the continuing need for protecting lubricants against contamination."



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compounding of suitable elastomers to be used for "O" rings, packings and seals. The development of high temperature elastomers started somewhat later than the fluid development and is just now approaching a point where recommendations for suitable elastomers can be made with some assurance of success at high temperature.

The best overall compound seems to be a plasticized neoprene, such as WADC compound 453-26C, which has a temperature range of —65 to 400 F. Although all of the available elastomers are marginal as seals, especially dynamic seals, at high temperatures (400F and above), a tabulation is given in Table VI of the recommended elastomers over varying temperature ranges.

A limited amount of work has been performed to study the effect of the silicate fluids on metals, fabrics, paints, coatings, plastics and adhesives. Some qualitative tests on the effect of MLO 8200 and Fluid A on various metals have indicated that

TABLE VI

Temperature Range	Elastomer Recommended
—65 to 400 F	Plasticized Neoprene (WADC Compound 453-26C)
—40 to 400 F	Neoprene WRT (Parko 36370)
+10 to 550 F	Poly FBA
+30 to 550 F	Poly Acrylate (WADC Compound 453-9A)

Elastomers recommended for use with silicate fluids.

the use of such metals as cadmium plating, brass, lead, tin plating, chrome plating and phosphorbronze should be avoided. Such metals as copper, magnesium, and terne plating will have to be tested in the particular application to determine their suitability.

Studies as to the effect of these fluids on fabrics have indicated that short exposure time does not adversely effect USAF fabrics. A series of long exposure tests at 250 F and short exposure tests at 400 F on paints and coating have resulted in the conclusion that the silicate fluids are less severe on these materials than diesters used in MIL-O-7808B. Therefore, paints and coatings which are satisfactory with the diester oils will be better when in contact with the silicates. The study of the effect of the silicate fluids on adhesive bondings and plastics has not progressed far enough to draw any definite conclusions.

Plans are now in progress to improve the MIL-H-8446 type fluids with respect to their weak points. The Air Force has California Research Corporation under contract to improve the hydrolytic stability of the silicate fluid mainly through structural changes and secondly through the use of the proper inhibitors. Other marginal properties such as rubber compatibility, foaming, and stability will be attempted to be improved under the contract.

In general, in the development of a 400 F hydraulic system, the fluid development has preceded the component and pump development. The development of the silicate ester fluid formulations have been a great stride forward toward hydraulic fluids which will operate in new weapon systems at high temperatures. Since the silicate fluids are comparatively new at this time, the companies producing them will undoubtedly make significant improvements in these formulations as more experience is gained in service use.

Continuing cooperation between industry and the services should yield, within the next few years, a fluid component combination with reliable operation under all conditions at 400 F for approximately 200 hours. ▼▼▼

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Ideas from a Sales Engineer

Elmer F. Heiser

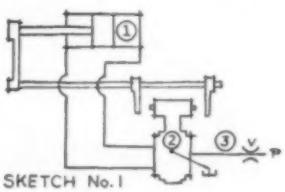
Elmer Heiser has been selling air and hydraulic components for 19 years. During this time he has solved many problems and admits to leaving some unsolved. He is the author of the book "Air and Oil Cylinders in Industrial Applications."

Hydropondering!

SOMEWHERE around our house there is an oil stone in a nice case. It's been a possession for years and its purpose is to sharpen carving tools when I'm in the mood to carve. The last time it was used I put it in a "safe" place and am still looking for it. Occasionally I will think of another place it might be stashed and will go take a peek. So far no luck.

The point is that it will turn up in the last place searched; which usually happens. You wonder then why you didn't think of the last place in the first place and thus save a lot of useless time. The same thing frequently happens when looking for the answer to a problem. You spend a lot of time chasing down blind alleys, turning up bum answers until finally the dawn breaks. The last answer then appears so obvious you wonder why it was not immediately apparent.

We bumped into a little problem recently which supplies a good example. Sketch 1 shows the simple system as originally established. It consists of a double acting hydraulic cylinder 1, a pilot operated 4-way valve 2, and a variable flow control valve 3. It should be pointed out that the flow control valve automatically governs the cycling of the cylinder within a range from one stroke in 2.5 minutes up to 20 strokes per minute to maintain a feed rate in relation to a variable demand. For simplicity and freedom from maintenance the pilot control of the 4-way is built as an integral part of the 4-way as shown. The small pilot valve reverses with approximately 3/16" travel and is operated directly by a trip arm attached to the cylinder. Quite a number of these units have been built and operate with complete satisfaction.



SKETCH No. 1

So much for the background; now for the added problem. It was desirable to add to the system an additional cylinder which would cycle at the same frequency as the first cylinder, making a complete stroke each time cylinder 1 completed a stroke. The original cylinder required approximately 80 cubic inches of oil for the stroke in each direction while the cylinder to be added would require approximately 40 cubic inches of oil.

So we started searching. The first blind alley produced sketch 2. The same automatic variable valve

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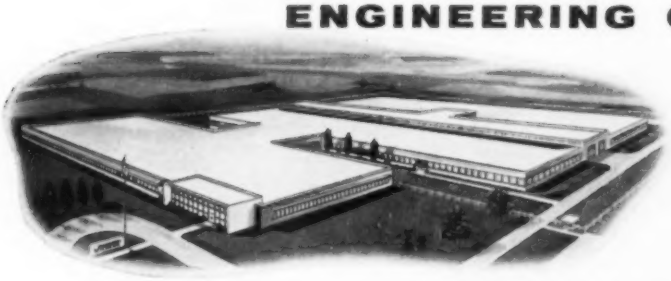

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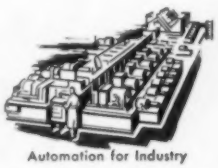
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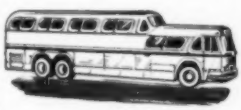
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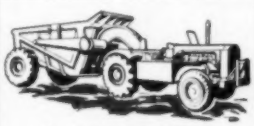
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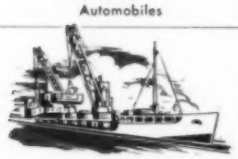
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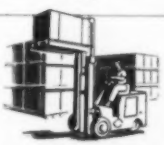
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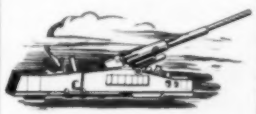
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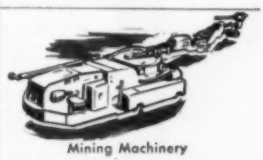
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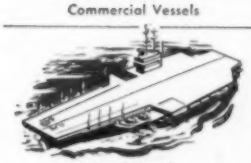
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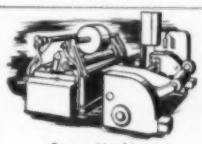
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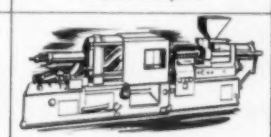
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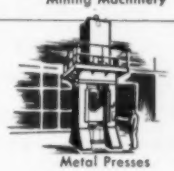
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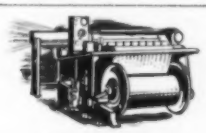
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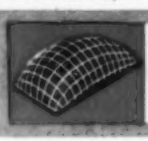
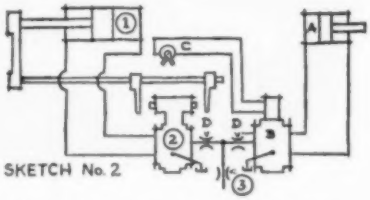

PneuBin—Pneumatic Bin Evacuators

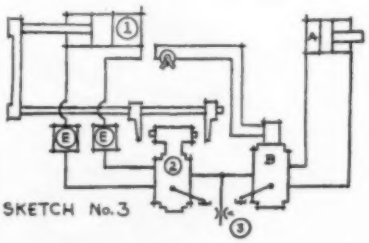
3 is used ahead of the system but a pilot operated 4-way B and a pilot valve C are shown to control the second cylinder. Half-heartedly we threw in a couple of variable ori-



fice valves D, knowing that they could only be adjusted to serve for the maximum 20 stroke/minute rate. As any fool can plainly see it misses the boat by a mile, but it could govern the reversal of the added cylinder A in relation to the stroking of the original cylinder if the resistance at cylinder 1 exceeds that at A. Obviously if cylinder 1 and cylinder A start at the same time (an optimistic thought) one will complete its stroke while the other sits back and waits. If No. 1 has less resistance it can go merrily along as it did before with our new cylinder marking time at one spot. All we accomplish then is that we go through the useless motions of starting the new cylinder by tripping pilot valve C at each end of the cylinder 1 stroke.

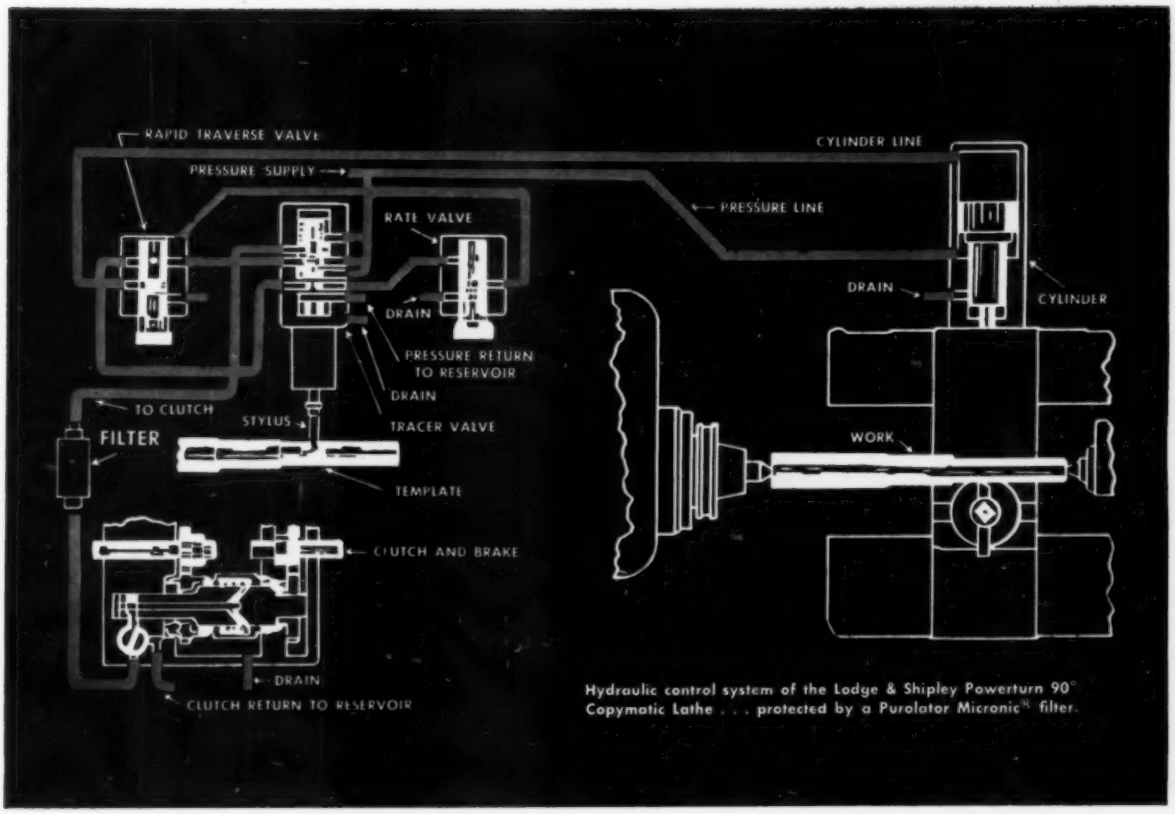
Sequences Replace Orifices

The next obvious answer is shown in sketch 3. Notice that we've brilliantly removed the use-



less orifice valves D and cleverly substituted a couple of sequence valves E. We must agree that now the new cylinder will cycle with the old and will always make a complete stroke prior to the movement of the original cylinder.

But now we have a different



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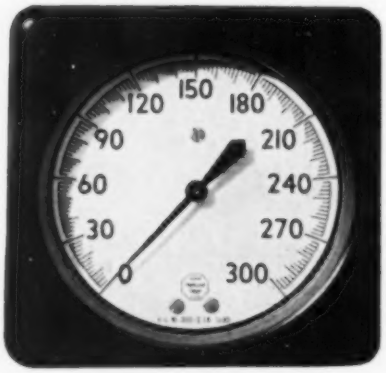

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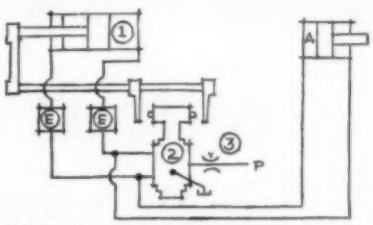
operation than originally intended. With this arrangement both cylinders do not move together but operate sequentially. We had initially hoped, and it was only a hope, that the use of a second 4-wa yvalve would have both cylinders moving together, controlled by variable valve 3. At this point we concluded that if sequential operation of the cylinders was the only way out it could be obtained more easily without the 4-way, so we tried sketch 4.

Fast Fuzzy Thinking

It might be in order along about here to leave the pursuit of a better answer and offer some additional explanation. You may have decided that the narration so far indicates some pretty fuzzy thinking and hydraulic bush beating. Well mebbe so. The intent, however, was to outline a problem and



SKETCH No. 4

then try to demonstrate the progression of thought in running down the answer. For a long time the idea of doing just that in this column has been tempting, but I have held back for fear what I term a progression of thought might be interpreted otherwise. Actually some of the arrangements described and sketched flitted by much faster than it takes to scribble them down on paper. In fact the use of sequence valves as shown in sketch 4 was the first idea seized upon, but it was promptly set aside because it provided only sequential action. Again, the exploration into, through, and then away from separate 4-way control for the added cylinder was an attempt to find the answer to simultaneous action of the cylinders.

Now we get back to the story

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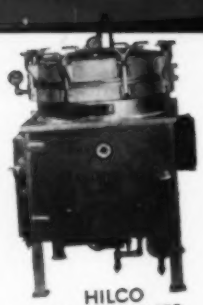

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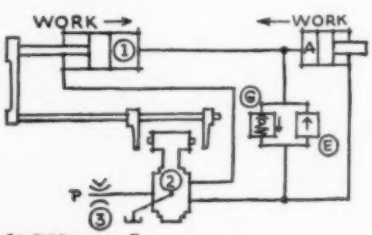
where it was left at sketch 4. We all decided after the go-around that this arrangement was basically very simple, it should be trouble free, and if necessary to achieve such simplicity the sequential cylinder action could be tolerated on the job. Acceptance of the simplicity left two disadvantages however. The first was that the pump capacity and connected horsepower had to be increased by 50% to handle the added volume of cylinder A. Second, the automatic flow control valve would be taxed somewhat to govern cylinder 1 in relation to demand now that cylinder A gets into the picture ahead of each stroke of cylinder 1.

Happy Loadings!

Then came the dawn. We knew that cylinder 1 operated under load in one direction while returning light at very low pressure. It so happened that the same was true of cylinder A and by a happy coincidence one was always to return "light" while the other was under load.

The really simple answer that provided simultaneous operation, maintains the same pump capacity, and leaves the automatic flow control operate as previously, is shown in sketch 5. Note the "light" or return ends of the two cylinders are connected by a common line. A jumper line ties from this common line to the connection on the



SKETCH No. 5

work end of cylinder A. This jumper has a low pressure resistance valve G paralleling a differential sequence valve E. The operation is as follows:

When pump pressure is connected to the "work" end of cylinder 1, oil from the opposite end

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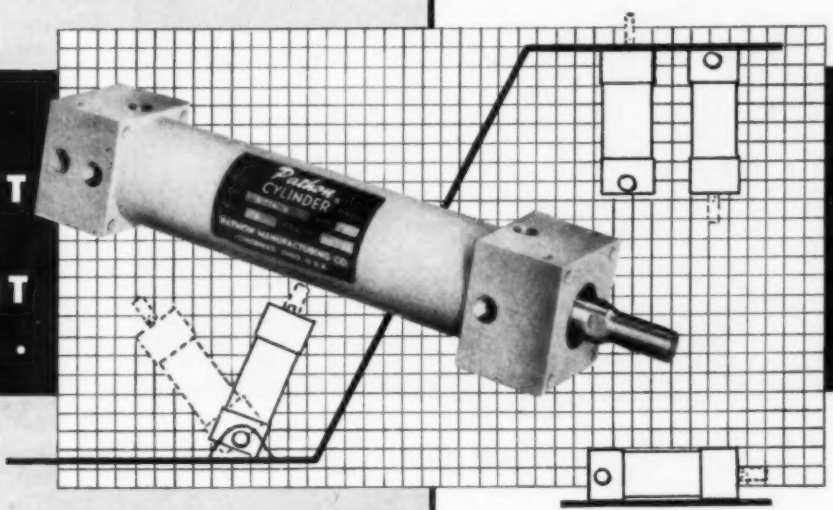

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cannot go to drain through the 4-way until a pressure is reached which exceeds the setting of resistance valve G. Resistance valve G is set slightly above the pressure required for the "light" return of A. Therefore, as cylinder 1 moves through its work stroke the discharged oil from the "light" end is conducted to cylinder A moving it on its return stroke simultaneously with the movement of cylinder 1. When A, returning light completes its stroke, resistance valve G opens and the remaining oil in cylinder 1 is conducted to drain.

Cylinders Feed Each Other

When 4-way valve 2 is reversed, pressure is directed to the "work" end of cylinder A. Differential sequence valve E is set sufficiently high to assure a complete stroke of cylinder A before opening. While cylinder A is advancing on its work stroke, the discharge oil from the "light" end is returning cylinder 1 (now running "light"). At the time cylinder A completes its stroke, sequence valve E opens and due to the differential remains open at very low pressure, allowing direct flow from the 4-way to cylinder 1 to complete its return stroke.

Tests showed that the pressure required for the return of each cylinder was so comparatively low it was not necessary to increase the horsepower input at the pump to handle a work and return stroke simultaneously.

High Grade Head Scratching?

So it goes. The story could be used to prove that the simple way to accomplish an end is not always obvious and usually takes some head scratching. On the other hand it may also demonstrate a mediocre grade of head scratching. But that's a risk one runs if he is so foolish as to let others know how or if he bothers to scratch his head. Besides if you are one of those guys who knew the right answer without all the bush beating maybe you can tell me where to look for that oil stone. ▼▼▼

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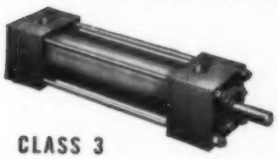

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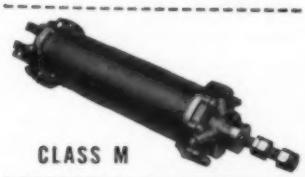

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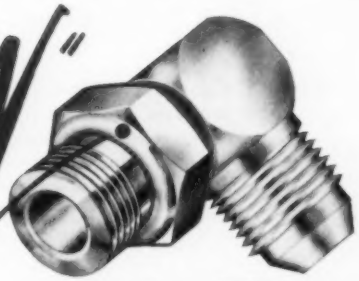

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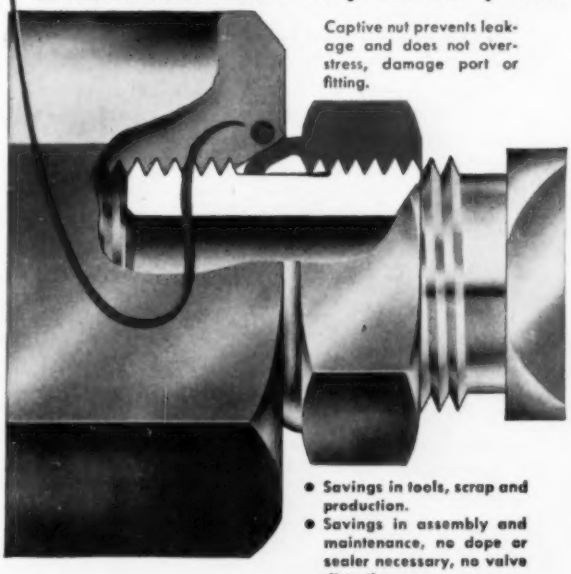

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Continued from page 66

for spool designs which minimize shock caused by rapid valve reversals.

When you can't unload a pump, is a heat exchanger or PV pump the only solution to heat problems?

To prevent heat problems, keep input power as low as possible; carefully select line sizes; adjust pressure valves to lowest value possible; select proper type of pumps ie. hi-lo or PV; consider use of accumulator and satisfactory unloading valve; avoid overloading of the power unit.

An important point made in this discussion was that the heat exchanger does not prevent the generation of heat—a PV pump can minimize the heat developed.

For a reciprocating cycle which is preferred—a 2 to 1 differential single end cylinder, or a 1 to 1 double end cylinder?

W. C. Gallmeyer of Gallmeyer & Livingston answered this question. Use of a 2 to 1 single end cylinder requires less space for a required working load and is affected less by leakage than the double end cylinder. However, it is easier to convert the double end cylinder to manual operation when necessary. Also, speed regulation at low speeds with a meter-out circuit can often be better with the double end cylinder because with the rod in tension it can be made smaller than the rod on the single end cylinder. This difference in rod size results in more oil available for metering, making the metering valve more reliable at low speeds.

Are machine tool builders attaching a hydraulic diagram to each machine as specified by JIC?

According to many users, drawings are not always attached. Several machine builders said that many customers don't understand the JIC symbols; therefore, picture diagrams often have to be included. There's the problem in the user's plant, of keeping track of the drawings and of putting them in the hands of the people who need them. And, to many machine tool builders, the users say: "Your maintenance, and operating manuals leave much to be desired."

What's being done about the need for adequate hydraulic tubing supports?

Making tube clamps or supports is pretty much an individual machine problem. Need for the clamp and shape of the clamp depends on line size, length of lines and grouping of lines. Proper supports do increase life and reliability of systems. Spacing must be studied to prevent amplifying any vibrations.

It was suggested that a study of energy absorbing materials for clamps would be worthwhile.

Also emphasized was the importance of shock control to eliminate the need for many clamps. Reduce shock by allowing enough time to shift valves.

Breaking long tube runs with bulkhead fittings which are rigidly mounted to the machine was suggested by Sundstrand's Dave Hutchinson. This technique makes assembly easier and reduces shock.

After considerable discussion indicated a need for clamps which apparently aren't commercially available, the moderator suggested that perhaps here is a new business opportunity.

PRESIDING over discussions were Russell Dustman, (left) Productive Equipment Manager, Chevrolet Division, General Motors Corporation, who represented the users; and Hans Ernst, Director of Research, Cincinnati Milling Machine Company, who represented the builders.

Is there a preference for a separate power unit for each head of a transfer machine?

No one at the forum voiced preference for one pump to power the feed for a group of cutting heads. Chrysler's J. S. Lapinski said that individual power units are preferred because of flexibility of control and lower maintenance. It is felt that using one pump for several heads would increase heat and leakage problems.

However auxiliary operations such as transfer, indexing and clamping are grouped to be powered by one pump when possible.

What remedies are there for "chatter" of hydraulically driven broach slides?

Among the points which must be carefully checked, Meyer Fox, of Lapointe Machine Tool, listed: unequal loads, steady oil flow, tool design, mechanical aspects, and cutting speed. Of prime importance is tool design—pitch of broach teeth must allow for chips—load per tooth is important.

Assuming the mechanical problems have been taken care of, hydraulic control with back pressure circuits may be adjusted to provide smooth cutting.

H. E. Tiffany, Sun Oil, pointed to the importance of proper way lubrication and consideration of the amplifying effects of compressed hydraulic oil on large cylinders and in long lines.

Fox pointed out that operating pressure had been

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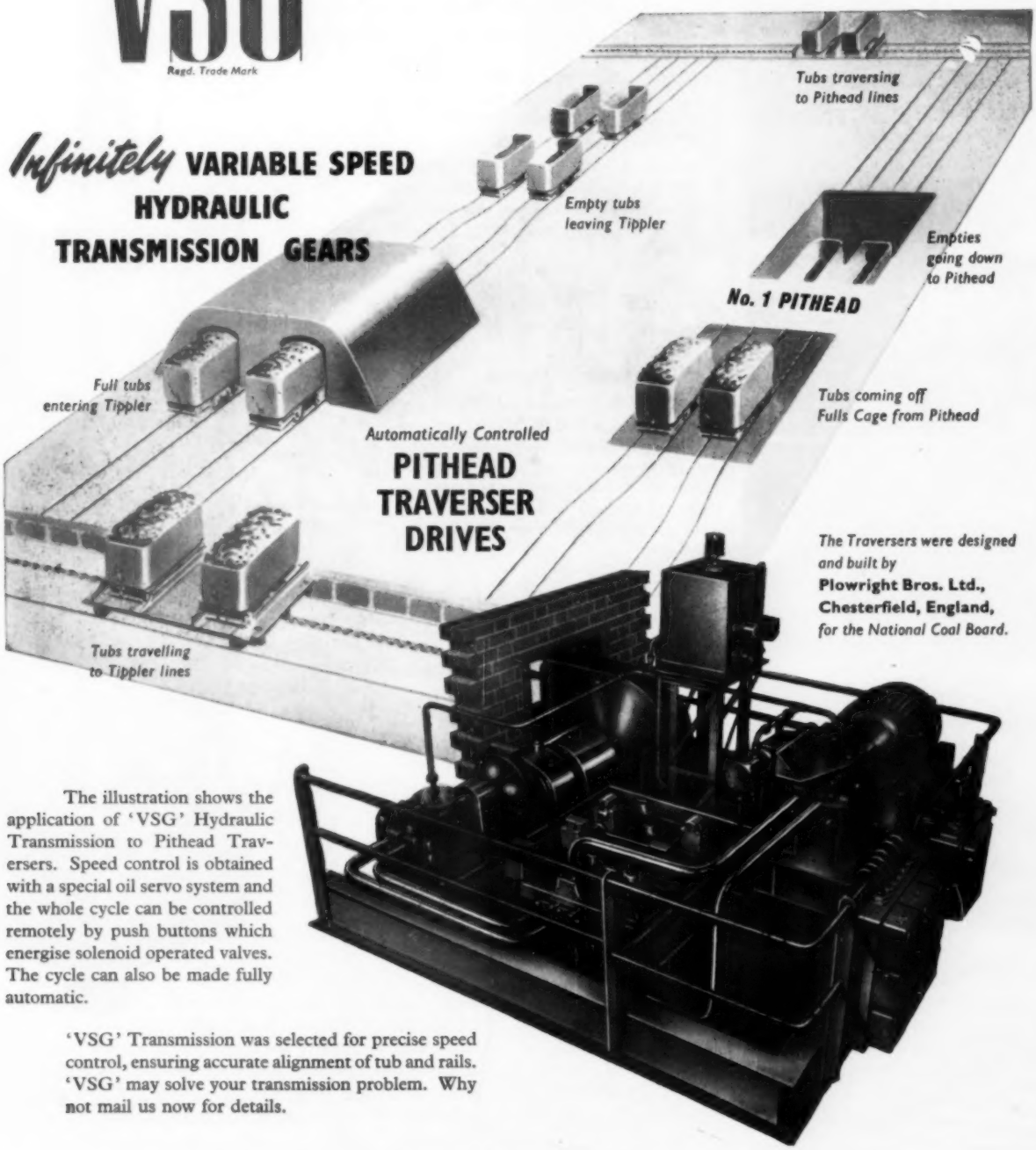
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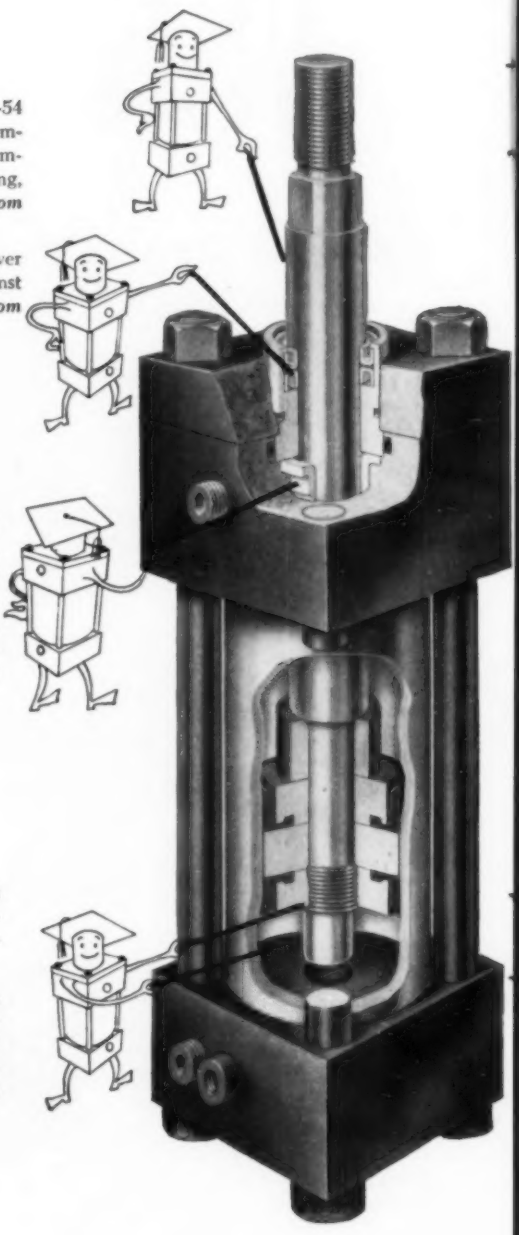

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reduced from 1000 psi to 750 psi because of chatter. He emphasized that in his experience 89 percent of chatter problems are cauesd by insufficient support, poor guides and other mechanical problems. He told of piping one machine with hose and one machine with rigid pipe. There was no difference in chatter. Elimination of chatter depended on correction of tooling. Spiral ground broaches help reduce chatter.

Summary: Broach chatter isn't usually a hydraulic problem.

What can be done to get the right size tubing in the circuit?

Getting the right size tubing requires complete knowledge of oil flows, length of runs, number of fittings and bends—it needs an understanding of the machine as well as the hydraulic circuit. JIC standards require that line sizes be shown on the drawings.

Jim Tankard of Zagar said they make a practice of using an oversize header to carry oil to the valve. This header acts as a damper for surge as well as holding down losses. The discussion indicated that there is considerable difference of opinion as to what should be the maximum fluid velocity in lines.*

**For a complete analysis of piping selection for efficient hydraulic circuits see: "How to Select Fluid Line Sizes", APPLIED HYDRAULICS, August, 1955.*

Why don't circuit designers give more information on piping of drains?

Users complain that miscycling of machines has sometimes been traced to backpressure in a drain line which was piped to return internal seepage and pilot return oil from a group of valves. One solution to this problem is the use of a vented drain manifold.* One user told of burnt out valve solenoids due to backpressure in drain lines.

Summary: During circuit design, don't ignore drain lines. Their size, length and location can be a critical factor in proper machine operation.

**See "Vented Drain Manifold Prevents Faulty Valve Aciton", APPLIED HYDRAULICS, April, 1955.*

Is it more desirable to put tubing on the outside of the machine or inside the machine base?

Again JIC Standards were cited as being aimed toward designs which provide greater accessibility and, therefore, less machine downtime. With tubing runs outside the machine, troubleshooting is easier, heat can be more easily dissipated, leaks can be readily located, and surge is more apparent. Circuit changes are easier to make and more care may be taken to neatly layout the tubing if it is outside the machine.

Although L. P. Cole, of General Electric, was willing to concede that tubing outside the machine offered advantages, he raised the question of appearance and utilization of space. Why let space

STOP PIPE THREAD LEAKS with

TRU-O-SEAL

TEFLON SEAL

PAT. PENDING

Does away with messy pipe "dope" compounds!

. . . Eliminates valve and pump damage caused by overtightening of leaky joints.

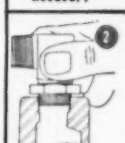
. . . "TEFLON" SEAL is immune to ALL hydraulic fluids and to steam, air, water, solvents and practically all gases and chemicals!

. . . Withstands temperatures from —100° F. to plus 500° F.!

. . . Fully field tested and proven by leading manufacturers!

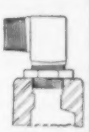
EASY INSTALLATION!

1 Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).



2 Thread pipe or fitting 4 threads into port. Point in desired direction.

3 Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).



TRU-O-SEAL stops present pipe thread leaks instantly, prevents future leaks, saves cost and labor of special or welded fittings. For 3000 psi operation (15,000 psi minimum proof pressure). Comes in ⅛" to 2½" pipe thread sizes.

Write for Prices and Complete Data

TRU-O-SEAL DIVISION
Flick-Reedy Corporation

2008 N. Hawthorne Ave. Melrose Park, Ill.

"Miller Fluid Power" is also a division of Flick-Reedy Corp.

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• Loxswitch limit switches outlast all others as much as 5 to 1 under severe operating conditions. That's because Denison switches have the soundest electrical circuits . . . achieved by combining the lowest impact with the fastest break and the heaviest contact pressure (see chart below). The impact mass of a Denison Loxswitch is 1/3rd to 1/4th that of competitive switches. Look at the results below. Examine these tests conducted by an independent laboratory on the three leading limit switches. Here's proof that you obtain a far sounder electrical circuit with Loxswitch . . . . . a switch that outlasts all others by millions of actuations!

Water tight plastic cover. Standard metal covers also available.

LOXSWITCH TRADE MARK gives you . . .

longest mechanical life
soundest electrical circuit
tightest enclosures

Electrical Features	Model L100WS LOXSWITCH	Heavy Duty Switch B	Heavy Duty Switch C
Contact Impact Mass—grams	2.45	11.03	7.83
Speed of 'Break'—in. per sec.	48	25	36
Typical 'Bounce'—milliseconds	4	16	4
Contact Pressure at trip point—oz.	8	4	4

All of the above Loxswitch features add up to far greater electrical life—3 to 5 times greater under severe operating conditions.

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R. B. DENISON MFG. CO.

102 St. Clair Avenue, N.W., Cleveland 13, Ohio

Specializing Exclusively in the Manufacture of Limit Switches

in the machine base be filled with air? Why not put lines on inside surfaces? To this, Frank Mackin, G. M. Institute said, "A machine base filled with vacuum is preferred to one filled with troubles." He also quoted the well know jibe—"What do you want to streamline a machine tool for. It's not going any place."

Nevertheless, many users and machine builders realize that appearance does influence saleability of machine tools. Jim Tankard, Zagar Tool, told of their practice of putting fluid lines in a trough on the outside of the machines. This results in good appearance and still provdies complete accessibility.

H. Fritschi, Cincinnati Milling Machine, suggested that when considering this question, perhaps a line should be drawn between standard and special machines.

To what extent is the formation of varnish in hydraulic oil a problem?

G. B. Hamilton, The Texas Co., stated that temperature control can minimize this problem. Reaction between oxygen and oil is slow under 135 F. Beyond this temperature the rate increases rapidly to reduce oil life and increase sludge and varnish.

What about "leak resistant" fluids?

H. E. Tiffany, Sun Oil Company, told about his company's development of a petroleum fluid having an additive which results in leak resistance. This additive is a polymer having a large molecule which retards the rate of oil flow. Leakage is further minimized by keeping seals effective. The oil conditions the seals to prevent leakage and brittleness. The oil gives a controlled swelling with no leakage. It was stated that the oil is stable, that is, shear action and temperature do not rapidly break down the large molecule polymer. Opeartion in systems up to 2500 psi has been satisfactory.

Have there been any new developments to stabilize viscosity through normal temperature ranges?

Premium grade oils are available with viscosity indexes of 100. At the present time, life of viscosity index improvers is relatively short because these improvers are high molecular weight polymers which are not shear stable.

What's the general reaction of the machine tool user and builder to the new internal straight thread O-ring boss fitting?

Very little experience was reported with this fitting. The idea has interest and available results seem favorable. However, the machine tool builders indicate that the choice is up to their customers. It was pointed out that one obstacle that presently prevents wide use of the straight thread fitting is the lack of components which take the straight

Automation with the *Hydromotor*

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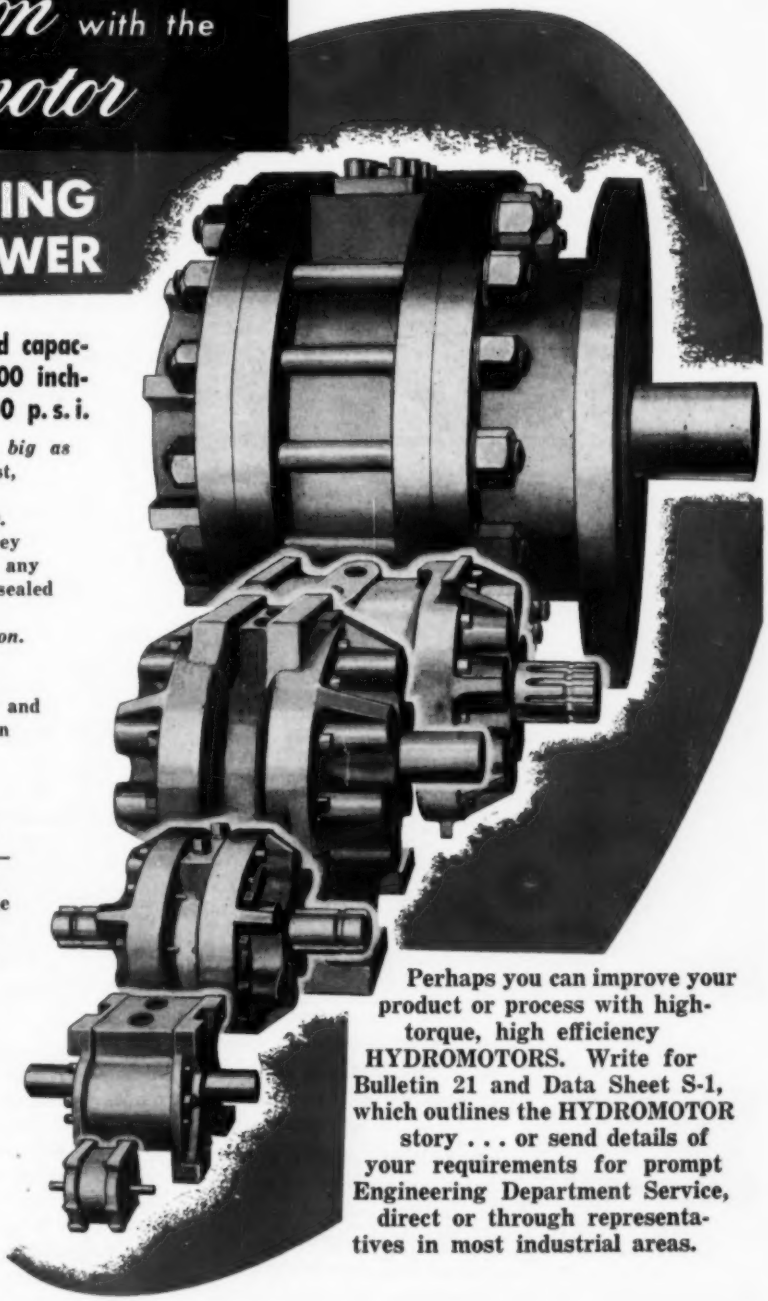
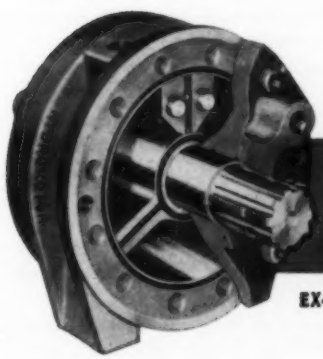
Wide choice of models and capacities from 150 to 1,000,000 inch-pounds of torque at 1000 p. s. i.

From the smallest *(only as big as your fist)* through the largest, HYDROMOTORS are *saving users time, space and money.* Compact and lightweight, they can be mounted anywhere, in any position and are completely sealed and self-contained to insure *dirt-free, trouble-free operation.* HYDROMOTORS eliminate expensive, bulky mechanical linkages, installation is fast and easy, maintenance is cut to an absolute minimum.

With HYDROMOTORS *reliable automation* can be achieved more simply. This reciprocating rotary actuator—operating with air, water or oil—develops instant full torque in either direction. Standard units travel 280° and develop 150 to 500,000 inch-pounds of torque. Double vane units—with maximum travel of 100°—approximately double the above torque values of the single vane unit IN THE SAME SIZE HOUSING. Special sizes are custom-built to individual specifications.



Perhaps you can improve your product or process with high-torque, high efficiency HYDROMOTORS. Write for Bulletin 21 and Data Sheet S-1, which outlines the HYDROMOTOR story . . . or send details of your requirements for prompt Engineering Department Service, direct or through representatives in most industrial areas.



Hydromotor
PRODUCTS DIVISION
EX-CELL-O CORPORATION • CANTON 2, OHIO

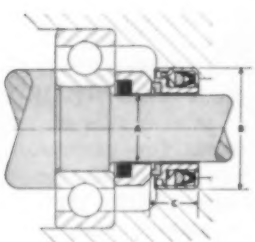
LOWERING • REVOLVING
LIFTING • PUSHING • PULLING
SWINGING • OPENING
CLOSING • CLAMPING • TURNING
INDEXING • OSCILLATING, ETC.

Circle 72 on Reader Service Card

More than 15 years ago, Sealol anticipated and designed the seals which are meeting today's space requirements . . . "Sealol" Balanced Pressure Seals. Their compact design . . . based on scientifically-minimized radial and axial dimensions . . . reduces housing sizes, keeps shaft lengths to a minimum, and allows bearings to be located closer to the load. Compare these dimensions with those of other standard seals available . . . and prove to yourself that Sealol seals are compact where it counts.

TYPICAL SPACE REQUIREMENTS - STANDARD "SEALOL" SEALS

A Shaft Diameter	B Seal O.D.	C Axial Length (Seal Only)
½	1.001"	.437"
1	1.626"	.531"
1½	2.188"	.563"
2	2.751"	.593"
3	3.939"	.875"
4	5.127"	.938"



Sealol seals handle pressures to 1500 PSIG, rubbing speeds to 15,000 FPM, and temperatures to 500°F. If your sealing problem involves speed reducers, hydraulic motors, gas turbines, rotary compressors, etc. . . . feel free to draw from our wealth of experience in this field to find your best answer. Request Bulletin 7 or send blueprints and specifications for speedy Sealol seal-utions.

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SEALOL

THE BALANCED PRESSURE SEAL

thread. One user said that his plant was reworking components to take the straight thread fitting.

It was stated that valve subplates having straight threads will soon be available. Some pumps now have them and by next year many components will be available with straight threads.

The statement was made that 50 percent of leakage is attributed to taper pipe threads.

Objection was made to uncertain assembly which could cause O-ring failure on the new fitting.

Metal-to-metal seal designs were also discussed. From the discussion it is apparent that much more experience must be acquired with these straight thread fittings before the machine tool user would be ready to standardize on a design on an industry-wide basis.

Has any success been experienced with the "Tru-Seal" nut with integral Teflon seal to correct tapered pipe thread leakage?

Users indicated that tests show promise. Assemblies have been made using moderate torque on 2500 psi systems. It was pointed out that the face which contacts face of seal must be smooth and square within 4 degrees. These nuts have held up well under vibration.

Have there been any new developments in fire-resistant fluids since the last Forum in 1954?

Bill Millett, Carbide and Carbon, pointed to these important steps: improved product quality; more sources of supply; greater knowledge on how to use these fluids, and increasing user acceptance of fire-resistant fluids.

To what extent are fire-resistant fluids being used on machine tools?

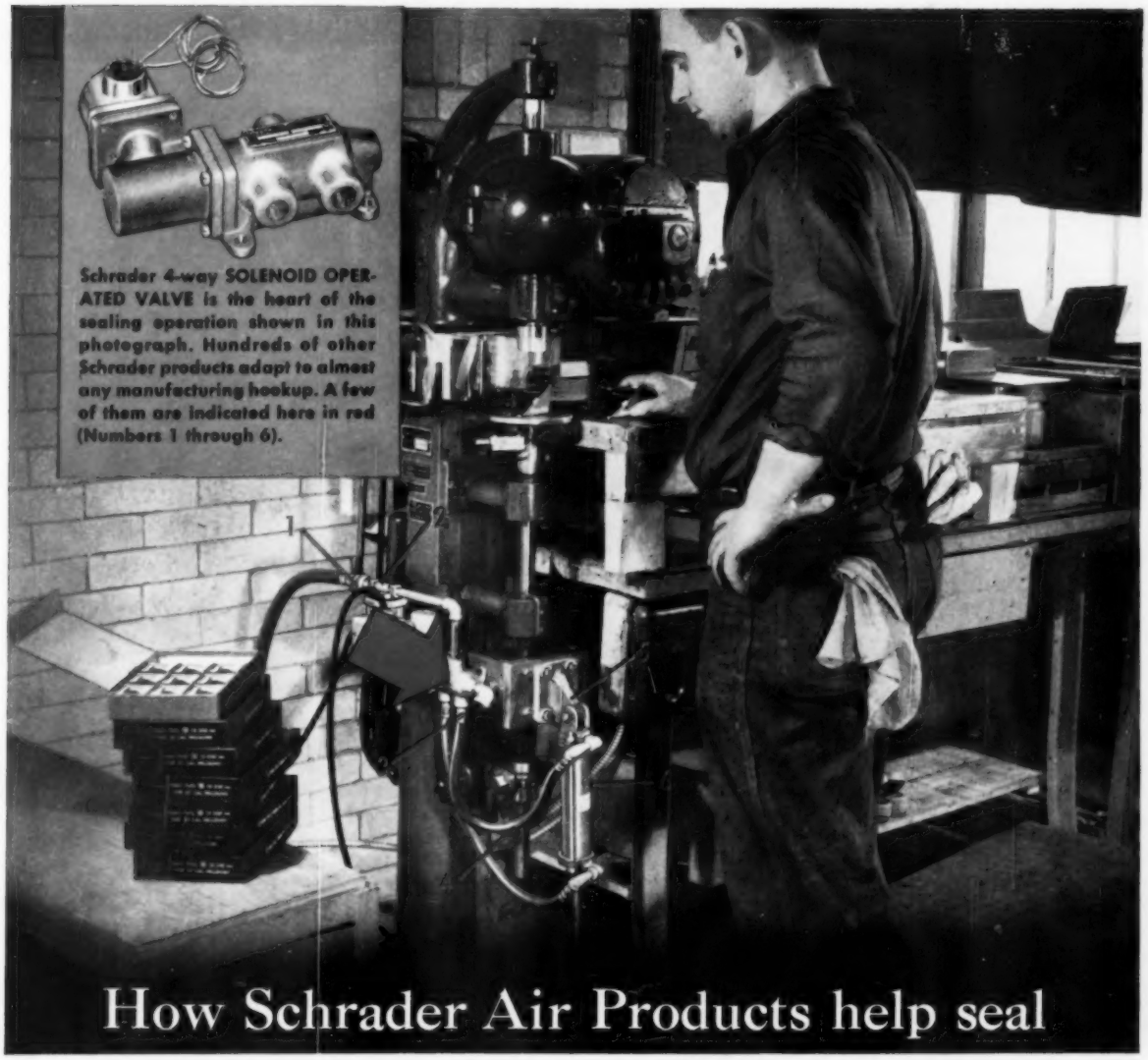
On machines that make chips there isn't much use of fire resistant fluids. However, there is increasing adoption of these "safety" fluids on machines located in a hot area which makes the hydraulic system a potential fire hazard. In the steel industry, fire-resistant fluids are used in the hydraulic systems on hot saws.

What is the influence of high specific gravity fire-resistant fluids on pump cavitation?

With fluids having a specific gravity of .8 and up, the tendency for pump cavitation is increased. Cavitation is readily prevented by locating the pump close to the fluid level and by assuring an unrestricted suction line—which is a good idea regardless of the fluid being used.

What is being done in design of equipment for use of water instead of oil?

Although little is being done to develop components to use pure water, Jim Robinson, of Vick-


Schrader 4-way SOLENOID OPERATED VALVE is the heart of the sealing operation shown in this photograph. Hundreds of other Schrader products adapt to almost any manufacturing hookup. A few of them are indicated here in red (Numbers 1 through 6).
1
2

How Schrader Air Products help seal

5000 pellet boxes per day—3 times faster!

Box sealing is a common operation performed by compressed air. Just how speedy it can be is demonstrated at a New York arms manufacturing plant, where 5000 boxes of pellets are crimped tight each day. The back-breaking job of crimping by foot power is eliminated, and the operator does not become fatigued.

Wherever operations are automated—in holding or positioning work, moving scraps or chips, or synchronizing actions—air can help. By making these steps automatic, more efficient manufacturing is achieved.

In many cases this can be done more economically with Schrader Air Products than in any other way. Upon request, Schrader engineers will assist you in planning for the most efficient use of air and in selecting the products best suited to your applications. Outline your problem to us . . . we'll be glad to help you. Or, send for the latest informative booklets which show Schrader Air Products that will help you increase production—economically.

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ESTABLISHED IN 1844

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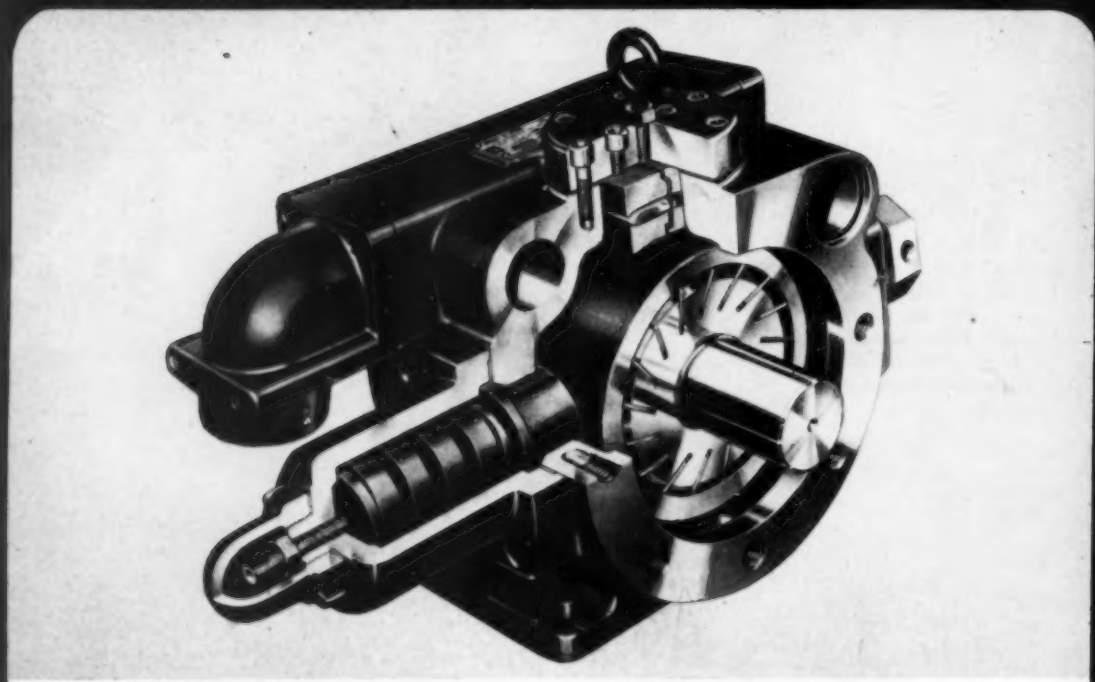
Division of Scovill Manufacturing Company, Incorporated
456 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

PYDRAUL . . . *PERFORMANCE-PROVED* IN RACINE PUMPS



SIMPLE, PRACTICAL, LOW IN COST describes Racine variable volume pumps. Check these outstanding features: Racine pumps are designed to use only the input power and eliminate power waste. Racine pumps use smaller reservoirs and lower horsepower. All the fluid delivered is put to work . . . only the amount of fluid needed is delivered! Heat losses are greatly reduced because relief valves are eliminated.

A tested combination: fire-resistant Pydraul fluid for safe economical operation of Racine pumps

Racine and Pydraul make a dependable, high-performing team and the record proves it! Racine for practical, low-cost power . . . Pydraul to eliminate the danger of fire, always present when ordinary hydraulic fluids are used.

Pydraul saves money on fluid consumption, too! It is a better lubricant than petroleum oil, has a longer service life than most other fluids and is reclaimable. You can return spillage to the system . . . use it again and again.

ARE YOU TAKING AN UNNECESSARY FIRE RISK by using flammable fluid in machines near hot metal, electrical contacts, open flame or other heat sources? A change to fire-resistant Pydraul can save you from a staggering fire loss. Talk to your Monsanto representative. He'll be happy to show you how you can have *positive* hydraulic fluid safety . . . at low yearly cost.

Pydraul Reg. U. S. Pat. Off.

PYDRAUL MEANS:

Fire Resistance
Excellent Lubrication
High Stability
No Corrosion
Re-Use . . . Again and Again

Pydraul is the **first** and only hydraulic fluid listed by Underwriters' Lab. From the Lab's service card: "The fire hazard of Pydraul is rated 2 to 3 in accordance with Underwriters' Laboratories, Inc's., Standard of Classification in which Ether rates 100, Gasoline rates 90-100, Alcohol (ethyl) rates 60-70, Kerosene (100°F. flash) rates 30-40 and Paraffin Oil rates 10-20."

WRITE FOR PYDRAUL F-9 BOOKLET!
Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Dept. OEM-3, St. Louis 1, Missouri.

MONSANTO

WHERE CREATIVE CHEMISTRY WORKS WONDERS FOR YOU

ers, mentioned work going on in atomic energy using pure water which is both "hot" in temperature and radiation. Someday, results of this work may alter design thinking for oil hydraulics.

Is there anything being done to standardize mountings of hydraulic cylinders?

The only report of standardization was that of J. E. Merkle, Ford Motor Co. He told of standards being prepared by Ford for 1000 psi hydraulic cylinders. The "standard" covers envelop and mounting dimensions. When prepared and accepted, these specifications will be Ford Standards, which do not infer industry-wide acceptance. However, the automotive plants, representing possibly the largest user group, can and do lead the way to standardization.

Have lock boxes that builders are installing on flow controls and panels been of value to the user?

Kurt Tech, The Cross Co., said he believed these key locked boxes are of real value. His company started to supply them several years ago because of requests from users and because many users had been working out cumbersome "home-brew" tamper-proof devices. Several thousand key locked boxes are now in use. There has been some problem with unauthorized personnel having keys but this is usually solved by proper supervision.

F. E. Fieldler, Chevrolet, said that a seal which required breaking has been most effective in preventing unauthorized valve adjustment. A broken seal indicates tampering which is some advantage over the key lock. It is up to the user to specify to the builder the type of lock he wants. Adjustments may be wired and sealed.

Has a non-viscous flow control valve been developed so that flow control will be uniform throughout normal temperature range?

Lou Jordan of Vickers told of a flow control valve which has excellent flow control characteristics over a temperature range of 80 to 140 F. To cover the entire range of flow control from near zero to 4½ gpm, four revolutions of the control knob is made. This valve should be available near the end of the year.

Why not make it mandatory for all pressure controls to be non-adjustable?

The users apparently feel that they need the adjustable feature for set-up purposes. Also product changes make adjustable valves desirable.

G. Brinkmann of Ex-Cell-O contends that the user could save himself many headaches if he would specify non-adjutsable valves. Afterall, when product changes require new operating pressures valve springs can be changed. Loss of flexibility and ease of adjustment could be advantageous—no downtime or miscycling caused by valve tampering.

When is a relief and replenishing valve needed for a fluid motor circuit?

Some amount of replenishing is always needed to prevent cavitation when a fluid motor is stopped. This replenishing can be done with a relief valve to provide brake action and a check valve for replenishing, or with a 4-way valve having an open center cross-over, or with a replenishing pump. Amount of replenishing depends on: length of lines, motor speed, and inertia.

What are the merits of small volume continuous by-pass filtration vs. periodic cleaning of the system?

Noone disagreed with W. Kasten, of Bendix-Skinner, who stated that the advantages of continuous by-pass filtration outweigh periodic cleaning. Users expressed concern over filter life. Use of a pressure gauge or some audio signal to indicate need for filter servicing was recommended. So was a relief valve to permit bypassing the filter when backpressure becomes excessive. Establishing a periodic cleaning schedule was recommended.

Is the use of magnetic strainers or plugs in oil reservoirs producing real benefits?

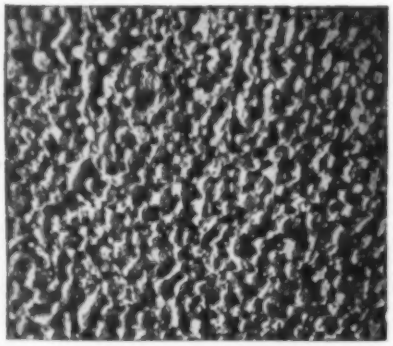
Users report effective use of magnetic filters which remove any metal chips, or metal particles from grinding operations, or fine metal particles resulting from wear.

Do users have a preventive maintenance program?

Some machine builders believe that many difficulties are the result of poor maintenance practices in the user's plant. And many users complain that the builder doesn't supply adequate information for proper maintenance. Needless to say, in general, maintenance procedures and assistance from the machine builder is better today than ever before. But much education remains to be done. It will payoff in greater productivity and wider acceptance of hydraulics.

Is there a flow meter available for use in pressure lines which could be used for troubleshooting in the same manner as an ammeter?

Such a device was reported available primarily for laboratory use. It lacks the flexibility of an ammeter. There is also a portable troubleshooting package now available which includes a flow meter and pressure gauge. Mention was made of using a fluid motor as a flow meter. Knowing motor displacement, a check of motor shaft speed tells gpm through the motor. ▼▼▼



Need a stainless steel filter with micronic pores?

You're looking at a 15-diameter magnification of PORO-KLEAN, CUNO's new sintered porous stainless steel.

It's already in use for filtering, separating, diffusing and metering fluids; for aircraft structural parts in boundary layer control and transpiration cooling, and for flame-proofing and sound deadening. Here's what PORO-KLEAN offers the designer:

1. 3- to 30-micron particle size retention as a filter.
2. Structural strength — PORO-KLEAN filter elements now in operation take a 1500 psi pressure drop.
3. Heat resistance — operating temperatures to 900°F.
4. Corrosion resistance — standard in 316 stainless steel. Low carbon content (0.03-0.05% max.).
5. No contamination of fluid — it's all metal, lint-free. No discharge of any part of filter into fluid.
6. Easily cleaned — with acids, alkalis, solvents or "back washing."
7. Standard designs—housings and elements for aircraft or industrial use.

Have you an application for this new PORO-KLEAN porous stainless steel? Discuss your problem with Cuno engineers or write for complete data. Cuno Engineering Corporation, 2-7 South Vine St., Meriden, Conn.

Poro-Klean housing and element for 12 gpm hydraulic fluid, OS-45-1, at 3000 psi operating pressure and temperatures from –65°F to 350°F. 52A

CUNO ENGINEERED FILTRATION

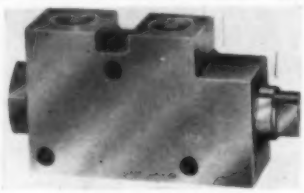
AUTO-KLEAN (edge-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

New Products continued

AIRCRAFT CHECK VAVE . . . operates at 1000 psi

Designation: Model 725P-4

Performance: Pneumatic controllable check valve has characteristics of free flow check valve in one direction and plunger-operated bypass valve in the opposite direction. Maximum load of 25 lbs is required to depress the plunger under rated pressure. Check valve



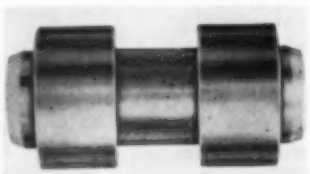
cracking pressure is 18 to 22 psi. Flow capacity is 2 cfm with a pressure drop of 20 psi in reverse flow condition .

Application: Valve is used to regulate operation of component units in a hydraulic system at a specific time. Also referred to as a timer check, sequence, or dump valve, the unit has a completely balanced poppet and corrosion resistant parts. Specific application is timing of gun-firing doors at temperatures of 200 degrees F. and 300 degrees F for 30 seconds.

Electrol, Inc.
Kingston, N. Y.
Circle 163 on Reader Service Card

FLEXIBLE GEAR COUPLING . . . has flexible hubs

Design: Spacer type coupling consists of flexible hubs on both the driver and driven shafts. The center unit, or spacer, has specially



designed teeth at either end, cut in such a manner that they mate with each sleeve in a spline fit and have no flexibility. The two sleeves connect the driver and driven units through the spacer. The entire unit is assembled and uncoupled without using wrenches or special tools.

Specifications: Units are made in standard models in sizes from 7/8 to 3 inches with capacities of 4 to 80 hp per 100 rpm. Larger size couplings and special types can be supplied.

Sier-Bath Gear and Pump Co.
North Bergen, N. J.
Circle 164 on Reader Service Card

AUTOMOTIVE PUMP . . . for power steering

Designation: Model VT-26

Specifications: Pump measures 3 7/16 inches from mounting face to rear and 5 1/32 inches overall. Weight of the pump is 9.65 lb exclusive of bracket and pulley. Rated capacity is 5 gpm at 1200 rpm. Pressure connection is SAE inverted flare-type fitting for 3/8-inch diameter hose with return connection for clamp-on hose.

Design: Integral relief and flow control valves are at right angles

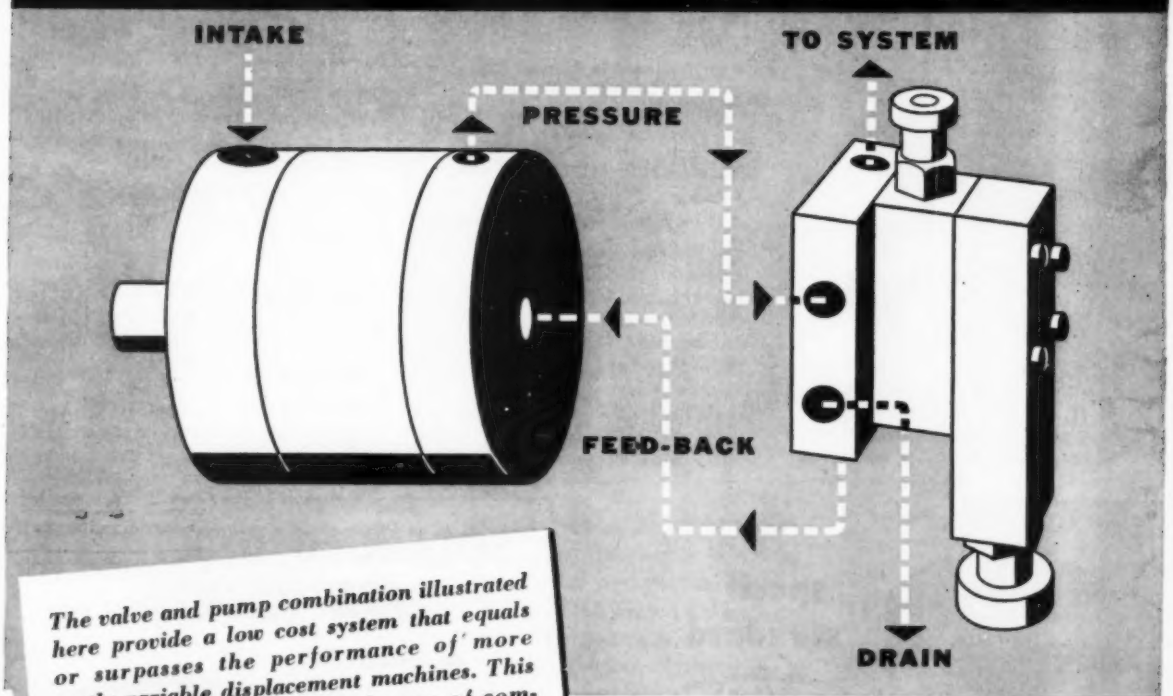
to pump center line adding to compactness. Pump operates between 100 and 1000 psi with overload protection within a range of 750 to 1050 psi. The flow control limits its delivery to the power steering system to 2.3 gpm regardless of engine speed, and actually reduces flow at the higher speeds where system delivery requirements are lower. This results in lower temperatures. The pump inlet is supercharged by use of the jet pump principle. Pump has a 27 cu. in. external reservoir mounted on top. Special brackets which have provision for adjustment of belt tension can be provided.

Vickers, Inc.
Detroit, Mich.
Circle 165 on Reader Service Card

Continued on page 132

a Low Cost VARIABLE DISPLACEMENT SYSTEM

Comprised of the SECO D5 Radial Piston Pump, and D5PF Valve



The valve and pump combination illustrated here provide a low cost system that equals or surpasses the performance of more costly variable displacement machines. This is accomplished through the use of completely new feed-back techniques for displacement control. (Patents Pending)

With the maximum pressure set, the flow control section of the D5PF valve adjusts the displacement of the D5 pump to maintain a selected flow, independent of load pressure and input speed—within the capacity of the pump. The flow is continuously adjustable from zero to a maximum of 5 GPM. Pressure is adjustable from 200 to ***2,000 PSI.*** Horsepower savings of as much as 85% are realized with the pressure compensation features of this system. Heating problems are negligible. The control valve can be located at the pump, or remotely, as required.

Send the Readers' Service Card for complete information.

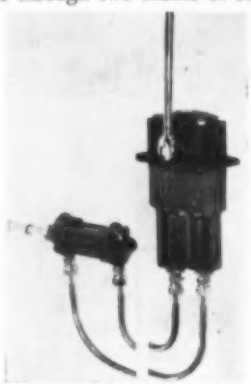
SECO
FLUID POWER

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

New Products continued

REMOTE CONTROL
. . . is self-contained

Features: System consists of master cylinder unit and slave cylinder. Capacity of the unit is 200 lb force through two inches of stroke



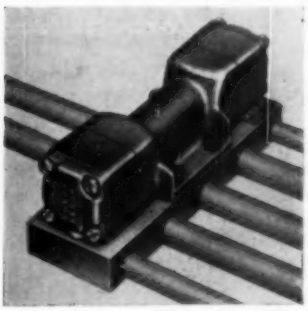
at the slave rod in both directions of stroke. An adjustable friction nut at the slave rod holds any set position against vibration or unbalanced loads. Ratio of output to input ranges from 3:1 to approximately 4:1. System provides smooth infinite control and sensitive feel. System provides smooth infinite and sensitive feel. Positive stroke in both directions does not depend on spring return or outside power sources. Automatic compensation for leaks is provided at both ends of stroke.

Trimount Instrument Co.
Chicago, Illinois

Circle 166 on Reader Service Card

MANIFOLD MOUNTED VALVE
. . . simplifies maintenance

Features: Valve is especially designed for installations where space is limited and speed of removal and installation is necessary. All piping can be installed, connected to the manifold plate, and purged before installation of the valve itself. Valve is then bolted on the manifold plate. Valve can be removed without disturbing piping. Valves are available in 2-, 3-, 4-, and 5-way types in sizes from ⅛ to 1-inch with any type of actuating device. Valve is rated for pressures to 500



psi. Manifolds with threaded porting in either the side or bottom are standard in aluminum and are also available in brass or steel.

Versa Products Co.
Brooklyn, N. Y.

Circle 167 on Reader Service Card

PETROLEUM FLUIDS
. . . have balanced composition

Designation: Mobil D. T. E.

Features: Eight new fluids ranging from light to very heavy weight are designed for high production,

specify standard

UNBRAKO

Dryseal-Thread Pressure Plugs

Use them in place of ordinary pipe plugs, or wherever liquids and gases must be contained under pressure. UNBRAKOs seal without compound. They are made of the same high strength alloy steels, have fully formed threads and the same internal wrenching feature as other UNBRAKO socket screws. Standard sizes—1/16" to 1¼"—are stocked by authorized industrial distributors. Ask your UNBRAKO supplier for Bulletin 883. Or write STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

STANDARD PRESSED STEEL CO.
UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

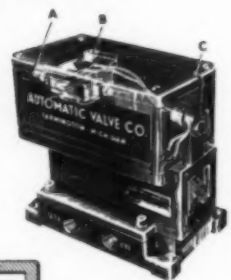
Circle 120 on Reader Service Card

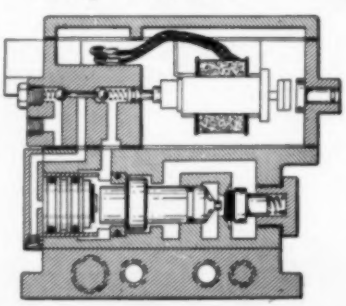
SOLENOID OPERATED AIR VALVES

designed to J.I.C. standards

¼" - ⅜" - ½" - ¾"

4-Way—Model 441





FEATURES

A—Manual Operating Button

B—Water-tight and Dust-tight Solenoid Enclosure with built-in Electrical Junction Box.

C—Cover chained to Body

Write for Information—Prices

AUTOMATIC VALVE CO.

37419 Grand River Ave. • Farmington, Mich.

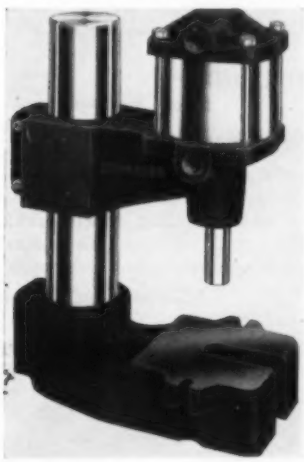
Circle 14 on Reader Service Card

close tolerances, increased speeds, heavy loads, and higher operating or local temperatures. Oils contain proper combination of additives to provide desired over-all performance with respect to oxidation resistance, protection against rusting and wear, ability to separate from water contamination, and resistance to foaming.

Socony Mobil Oil Co., Inc.
New York, N. Y.
Circle 168 on Reader Service Card

AIR PRESS
. . . 0 to 7 inch height

Features: Press is available as single-acting for impact applications and double-acting for squeeze and power withdrawals. Control and speed of heavy duty cylinder



can be varied as necessary. Press has two bolts for adjusting height and has a swing arc of 2 inches on each side of center. Unit has sturdy cylinder bracket and extra heavy cylinder wall with base providing solid foundation.

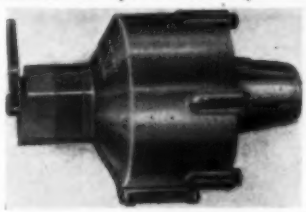
A. Schrader's Son
Div. Scovill Mfg. Co., Inc.
Brooklyn, N. Y.
Circle 169 on Reader Service Card

INTENSIFIER
. . . for clamping

Designation: Type 180,000

Application: Intensifier eliminates hand pump and delivers maximum of 2 cu in oil at 1950 psi when coupled to air pressure of 100 psi. Use of the intensifier permits smaller cylinders using higher pressure.

Features: Control valve is incorporated in intensifier and can be remotely actuated. Consumption of compressed air is .23 cu ft per operation. Future developments call for oil delivery of 10 cu in for clamping systems employing a large number of cylinders. Hydraulic



pressure on clamping cylinders is automatically maintained.

Power Jacks Ltd.
London, England
Circle 170 on Reader Service Card

SELF-LOCKING SCREW, BOLT
. . . uses Nylon insert

Designation: Nylok

Design: Nylon pellet is inserted in a hole drilled part-way through the threaded part of the screw. When the screw is installed in a tapped hole, the exposed part of the nylon pellet is compressed between the mating threads. In an attempt to regain its original shape, the Nylon forces the threads together under pressure. This pressure increases the

Continued on next page

When you need trouble-proof adhesion between a rubber compound and metal, count on GORBOND, Goshen's exclusive bonding process. Combining such properties of strength, resiliency, insulation, longevity and others in a single unit, to meet specific requirements, is a GORBOND specialty. Besides, this superior process meets today's most exacting tolerance, materials and performance specifications. We'll gladly work with you on even the toughest problem involving attachment of metal to rubber (natural, synthetic or silicone).

See our Catalog in Sweet's Product Design File.

Our 40th year 1916 - 1956

Goshen Rubber Co., INC.
CUSTOM DEVELOPMENT AND FABRICATION SINCE 1916
1376 S. TENTH ST., GOSHEN, IND.

make **GOSHEN** *your* **HEADQUARTERS** *for*
NATURAL SYNTHETIC & SILICONE
RUBBER PARTS AND COMPONENTS

Custom-Made
TO YOUR EXACT SPECIFICATIONS

Send for
FREE BROCHURE
This 8-page brochure and handy file folder tells how Goshen Rubber can help you. Send for your free copy today.

Circle 56 on Reader Service Card

New Products continued

friction between the metal surfaces, thus resisting the tendency of the bolt to loosen in service.

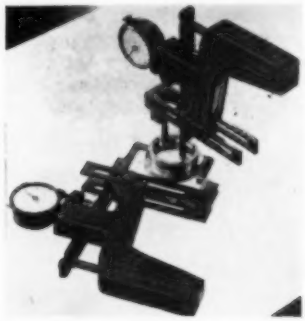
Performance: Screws with inserts provide uniform locking force from top to bottom of the screw, present high resistance to corrosive effects of most acids, and give good sealing against fluid leaks along the threads. Locking insert eliminates need for lock-washers, adhesives, and wire-locking.

Standard Pressed Steel Co.
Jenkintown, Pa.
Circle 171 on Reader Service Card

O-RING GAGE
. . . measures ID, OD

Application: Gage does not require changing dial for any measuring job. Unit measures O-rings, bores, pitch diameters of even-numbered splines and gears, grooves, recesses, inside spherical radii, and out-of-round. Instrument also checks concentricity of outside diameter against groove diameter.

Operation: Slide is reversed for outside measurements. Interchangeable tips provide a complete range from zero to 5.750 inches for outside measurements and from .187 to 6.270 inches for inside measurements. Measuring tensions are easily and quickly changed if needed. No hand pressure is needed to actuate the sensitive measuring bar. Tips are precision machined to assure accurate fit. Tips are hardened and hard chromed for long, accurate life.



Mueller Laboratory
Pasadena, Calif.
Circle 172 on Reader Service Card

DRILL UNIT
. . . for limited space

Designation: Model 150

Features: Drill unit operates at 9000 rpm maximum speed and can be used for drilling, reaming, tapping, countersinking, and other machining operations which require

Continued on page 136

TRU-FLATE'S Famous Industrial Blo-Dri Gun

- *It Sprays*
- *It Cleans*
- *It Blows*
- *It Dries*

5 Times More Air! !

Worried About...

Volume
Pressure
Cost
Safety

. . . then try the Tru-Flate all-purpose No. 410 Blo-Dri Gun—used extensively throughout the country by large and small industrial factories, foundries, shops, garages, etc. Hand-lever controlled valve can be adjusted from a mere whisper to a full scale blast. Delivers five times the volume of an ordinary blow gun. Highly recommended by safety, maintenance and production engineers.

Write for Catalog on this and other custom designed Tru-Flate Blow Guns Today

TRU-FLATE, INC.
888-92nd Avenue • OAKLAND 3, CALIF.

Circle 129 on Reader Service Card

UNITIZE WITH HOSE!

It is always good practice to build machinery in easily separated units. With hydraulic hose and Mayson Hose Swivels you merely push couplings together. The hookup is vibration proof and easily separated for servicing.

Dealer's name and catalog for the asking.

J.I.C. Standards
Sizes ¼" to 2" P.T.
Male or Female

MAYSON MFG. CO.
4332 Horatio Street • Detroit 10, Mich.

Circle 87 on Reader Service Card

Circle 128 on Reader Service Card

NEW! Non sticking, greaseless, long life SHORT STROKE SOLENOIDS for original Equipment or replacement use

FULL CAPACITY
1 to 300 lb at 85% voltage; 1.4 to 420 lb at 100% voltage. Strokes ½ to 1½ inch

INTERCHANGEABILITY
Complete interchangeability with National Acme solenoids.

Only Trombetta Solenoids Offer All These Features: **Heavy non-magnetic** metal guides for plunger head eliminate sticking and dragging; permit mounting solenoid in any position; make it unnecessary for precise plunger alignment; eliminate need for heavy grease lubrication; increase solenoid life and reliability. **Three contact surfaces** which are pole shaded result in quiet solenoid operation. **Three impact surfaces** triple the life of this solenoid as compared with a solenoid having only one impact surface even if that surface has a spot of hard metal. **Impregnating coil** with best waterproof, oil-proof and acid-proof varnishes and baking carefully eliminates troubles.

Solenoids can be furnished for short or long strokes with duty cycles up to 600 per minute. Write for Bulletin EE 178-A

TROMBETTA SOLENOID CORP.
328-A N. MILWAUKEE ST. MILWAUKEE, WISCONSIN U.S.A

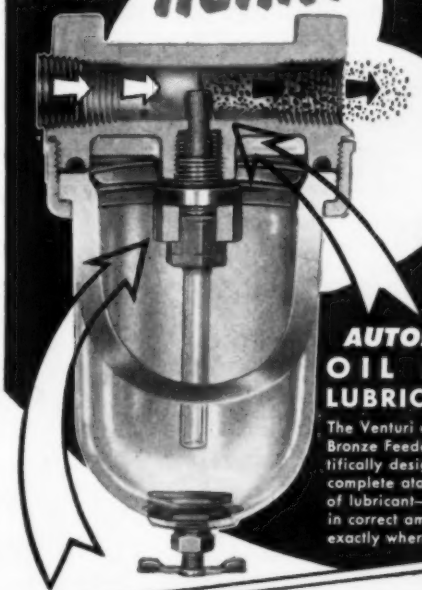
5100 Series Relief Valve. In-line design. Gas or liquid to 1000 psi.
200 Series Check Valve. For almost any service — gas or liquid up to 3000 psi.

CIRCLE Send for Information Today SEAL *precision valves*

JAMES-POND-CLARK
2181 East Foothill Boulevard, Pasadena California

ARROW AIR LINE LUBRICATOR

LOOKING INTO THE HEART OF THE PRODUCT



AUTOMATIC OIL MIST LUBRICATION
The Venturi and Porous Bronze Feeder scientifically designed insures complete atomization of lubricant—delivered in correct amount—exactly where required.

"PATENTED"
ARROW LUBRICATOR FEEDER ASSEMBLY
- TAMPER-PROOF ADJUSTMENT
- VISIBLE FEEDER ADJUSTMENT
- AUTOMATIC OIL MIST LUBRICATION ONLY WHEN EQUIPMENT IS IN OPERATION

ARROW AUTOPNEUMATIC CONTROLS
Improve pneumatic machine and tool operation and efficiency. Reduce maintenance and repair costs. Prevent work stoppages.

ALL THE FACTS ARE YOURS..
ARROW engineers and field consultants at your service.
Catalog and engineering data on request.
Your Inquiries Invited.

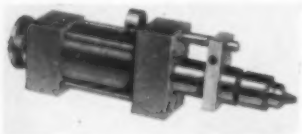
ARROW TOOLS, INC.
1902 S. KOSTNER AVE. • CHICAGO 23, ILL.

 Circle 75 on Reader Service Card

Circle 13 on Reader Service Card

New Products continued

rotary and feed motions. It is especially applicable for limited space applications and has dimensions of 2⅛ x 3¼ x 8 11/32 inches. The



½-inch capacity unit has strokes of 1½, 3, and 6 inches. All wear surfaces are ground and plated to provide a maintenance-free production tool.

Alkon Products Corp.
Hawthorne, N. J.

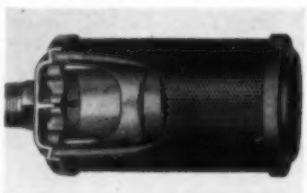
Circle 173 on Reader Service Card

PNEUMATIC MUFFLER
. . . has 4-port deflector

Designation: Atomuffler

Design: New 4-port deflector combined with internal acoustical resonator gives uniform air dispersement with more effective impingement, resulting in better noise cancellation and improved air flow. Deflector disperses air outward in a lateral-radial pattern, reducing velocity to a minimum and eliminating oil fog and water spray.

Construction: Quicker more positive installation is ensured with new hex-head feature, and installation can be made with ordinary wrench. Double lock-tight construction re-



sists vibration and holds fast under severe jolting. Unit is available in sizes from ⅛ to 2 inches NPT.

Allied Witan Co.
Cleveland, Ohio

Circle 174 on Reader Service Card

O-RING MATERIAL
. . . wide temperature range

Designation: 730-70

Specifications: Material meets requirements of high temperature systems in sonic military aircraft operating with MIL-O-5606 hydraulic fluid, as well as MIL-P-18017B(ASG) and prior specifications. Compound has temperature range of —65 to 275 degrees F established by exhaustive performance testing. All sizes shown on MS28274 drawing are available.

Precision Rubber Products Corp.
Dayton, Ohio

Circle 175 on Reader Service Card

3-WAY SLEEVE VALVE
. . . for cylinder mounting

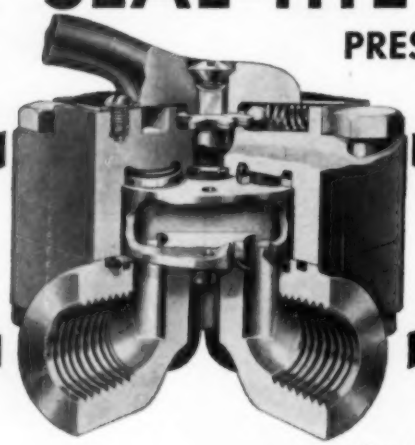
Operation: Designed to control clamp type and similar single acting air cylinders, in-line valve has sliding sleeve. In downstream position, air flows through to cylinder. In upstream position, inlet air is cut-off and exhaust ports opened. An extension on the sleeve deflects exhaust air to protect operator from air blast, blown chips, or dirt.

Specifications: Valve is available in ⅛, ¼, and ⅜-inch NPT

REPUBLIC

New SEAL-TITE VALVES

PRESSURE BALANCED



GASES 0-500 psi

- ⅛" to 1" FPT—2, 3, 4-way
- Zero leakage. Increased pressure tightens seals.
- Positive flow control.

0-1000 psi LIQUIDS

- −65° to 160°F temperature range.
- Long wear, self-cleaning seats.
- Turning ease. Short handle.

Ask for Catalog No 356. Distributors in principal cities coast to coast.

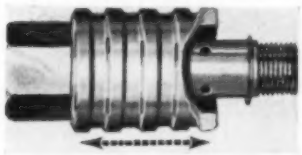
190

REPUBLIC MANUFACTURING CO.

RM

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

sizes and may be mounted directly in the cylinder port or at any convenient location in the airline. Inlet connection is female, outlet is



male. Valve body is machined from solid stainless steel, Sleeve is brass with oil-resistant O-rings.

Modernair Corp.
San Leandro, Calif.

Circle 176 on Reader Service Card

PRESSURE SWITCH . . . unaffected by acceleration

Designation: Series 600

Design: Totally enclosed switch is for use with hydraulic or pneumatic pressures from 0 to 1200 psi and is extremely sensitive to

low operating pressure. The calibration is not affected by acceleration, and the unit will repeat accurately. Pressure switch is totally enclosed in cast aluminum alloy housing, and pressure adjustment may be made without interfering with the pressure element. Unit may be mounted in any position.

Alloy Bellows Engineering Co.
Cleveland, Ohio

Circle 177 on Reader Service Card

FLARELESS FITTING . . . for SAE O-ring boss

Designation: 7000 Series

Design: High pressure, straight-thread hydraulic tube fitting is designed for minimum close coupling, positive seal, and ease of assembly. New phosphate finish is resistant to non-flammable hydraulic fluids as well as petroleum base fluids. Fitting withstands higher operating pressures without use of back-up rings. Fitting results in less O-ring distortion and longer O-ring life. New type O-ring seal is also designed for air application and tested to operate at temperatures from —55 degrees F to 212 degrees F. Fitting is available in 31 styles in sizes from ⅛ to 2 inches.

The Weatherhead Co.
Fort Wayne, Ind.

Circle 178 on Reader Service Card

UNIVERSAL MOUNTING . . . eliminates misalignment

Features: Universal cylinder mountings are available in two

forms including a hinge-mount cylinder with universal mounting brackets at each end and a cylinder with universal trunnion and universal mounting bracket for the rod

Continued on next page

JOY

SURGEPRUF

HYDRAULIC HOSE and RE-USABLE COUPLINGS

PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Insure longer wear in your hydraulic hose assemblies—and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.

NO SPECIAL ASSEMBLY TOOLS REQUIRED

You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.

CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively.

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

Get complete data on Surgepruf:
Write for FREE Bulletin 77-19
Consult a Joy Engineer

WSW H 5515-77

JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

Circle 77 on Reader Service Card

New Products continued

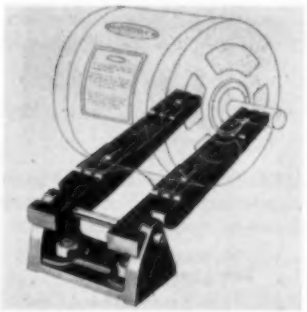
end. Mountings are available with cylinders from 1½ to 3-inch bores. **Application:** Common applications for the universally mounted cylinders include operation of hopper gates, elements rotating on shafts such as gear segments and levers, and objects moving on wheels or tracks such as trucks or transfer tables. They also compensate for deflection and misalignment where cylinders are connected to structures that are riveted, bolted or welded together.

Hanna Engineering Works
Chicago, Illinois
Circle 179 on Reader Service Card

MOTOR BASE
. . . maintains belt tension

Designation: Auto-Tension

Features: Inexpensive motor base automatically compensates for belt stress and maintains exact belt tension for all load conditions. The greater the load, the greater the belt tension reducing wear on both



belts and bearings. Belts can be changed without disturbing the mounting and operation is quiet. Base is available in NEMA motor frame sizes from 1/6 to 7½ hp and is designed for use with horizontally positioned drives.

Lovejoy Flexible Coupling Co.
Chicago, Illinois
Circle 180 on Reader Service Card

PISTON SEAL
. . . for wider tolerances

Designation: Class 4

Design: Deep convolution, constant area diaphragm is of flange design for use in air and fluid operated instruments ,actuators, and motors. Seal was developed for use in

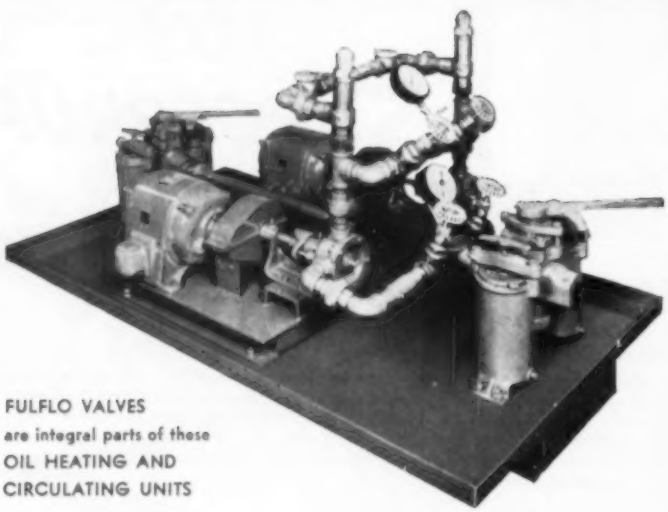
instruments and machines having natural parting surfaces between cylinder and mating metal surfaces. Seal then functions as a gasket preventing leakage at this parting surface.

Specifications: New unit is available in sizes from 2.75 to 6 inches. Diaphragm uses numerous elastomers and fabrics such as Nitrile rubber and Nylon or silicone rubber and Dacron. Seal is free-positioning with complete relaxation at all points within its designated stroke, and is virtually free of friction or spring gradient.

Bellofram Corp.
Burlington, Mass.
Circle 181 on Reader Service Card

Continued on page 140

FULFLO OIL PRESSURE RELIEF VALVES
INSURE CONSTANT, UNIFORM, PRESSURE



FULFLO VALVES
are integral parts of these
OIL HEATING AND
CIRCULATING UNITS

engineered and built by
HAUCK MFG. CO., Brooklyn, N. Y.
Manufacturers of Oil and Gas Burners and Equipment

These valves are installed in a jiffy . . . and stay put! Desired pressure is determined by 5 springs . . . NO MAINTENANCE REQUIRED. From 0# to 500#. Standard and flange models, pipe sizes: ¼" to 2".

Write on your letterhead for personal copy of

FULFLO MECHANICAL DATA BOOK

Please specify if for Pumps or Valves, or both.

FULFLO THE FULFLO SPECIALTIES CO. Inc.
PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

Circle 121 on Reader Service Card

STAR Hi-Lo

TWO SPEED CONCENTRIC PUMPS

Ask for Catalog #555.

HAND OR FOOT OPERATED WITH SINGLE LEVER OR PEDAL

Two speed construction provides automatic change-over during operating cycle from high speed low pressure to low speed high pressure.

MAXIMUM CAPACITY 10,000 P.S.I.

Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—5 models: (½"-⅞"), (½"-1¼"), (½"-1½"), (⅝"-1½"), (½"-2¼").

Special engineering counsel and proposals cheerfully submitted on request.

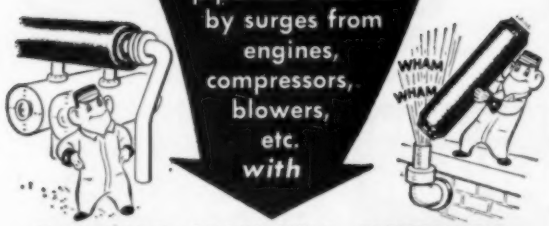
Representative areas available

STAR JACK CO., INC.
420 LEXINGTON AVENUE, N.Y.C. 17
PLANT: RIVER GROVE, ILLINOIS

STOP

NOISE from air, steam and gases discharged to atmosphere

PULSATION in pipelines created by surges from engines, compressors, blowers, etc. *with*



BURGESS-MANNING SNUBBERS

They are engineered to effectively correct your specific noise and pulsation problems. You will profit through better neighbor and employee relations and avoid compensation claims.

Write for full information.

BURGESS-MANNING COMPANY
Sound Engineering
769 East Park Avenue, Libertyville, Illinois
Dallas, Texas

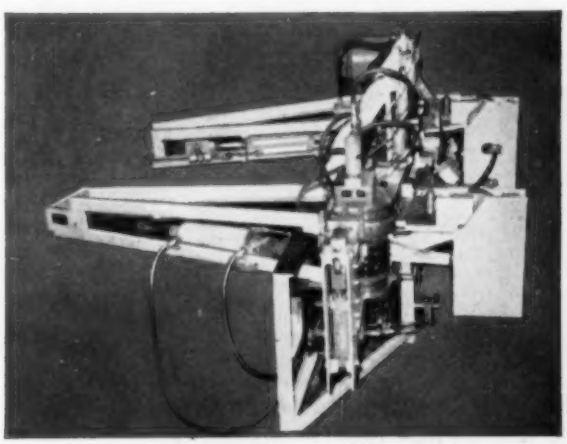
Champ®

HYDRAULIC HOSE ASSEMBLIES

for Longer, Trouble-Free Power Delivery to Meet Your Machine Tool Requirements

- **STEEL COUPLING**—for precision fit
- **MAXIMUM INNER DIAMETER** —for high volume flow

- **QUALITY HOSE** —for long life with all hydraulic fluids
- **SERRATED SLEEVE *AND* STEM** —for maximum holding power
- **COLLAR LOCKS TO STEM**—to prevent blow off.



The power line carrying oil to actuate your hydraulic unit *proves* the performance of your machine tool design. Champ precision made hydraulic hose assemblies are engineered to meet your specific performance standards . . . in a large range of sizes . . . in a variety of assembly types . . . for working pressures up to 4500 PSI. ® Reg. T. M.

Write for Catalog No. 8001 for details on the Champ line of hydraulic hose assemblies . . . today!

Champ®
DIVISION OF
HOSE ACCESSORIES COMPANY
LEHIGH AVE. AT 17TH STREET • PHILADELPHIA 32, PA.

Circle 23 on Reader Service Card
Circle 64 on Reader Service Card

New Products continued

COMPRESSOR FILTER
. . . has oil bath

Designation: LPD

Operation: Air is drawn in and is directed through an air-flow

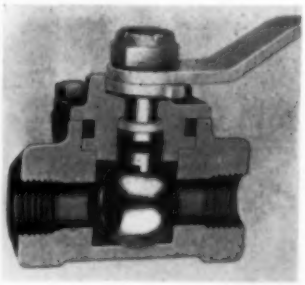
regulator tube to an oil control pan. The air picks up droplets of oil which are carried up through a diffuser cone where air and oil are thoroughly mixed and air is scrubbed. The air then passes through the cylindrical filtration element where dirt particles and oil droplets are removed permitting only clean, oil-free air to flow to the compressor.

Specifications: Filter with capacity from 800 to 3500 cfm has pressure drop of .6 to 4.8 inches of water gage. Largest model for capacities of 16,500 to 24,000 cfm has a pressure drop from 1.9 to 3.5 inches.

Air-Maze Corp.
Cleveland, Ohio
Circle 182 on Reader Service Card

2-WAY VALVE
. . has ball design

Design: Valve is of forged construction increasing strength and eliminating porosity. Round opening in ball allows piping to handle fluids with minimum turbulence in the line. Ball valve provides wiping action on both sides of the ball. Seating materials available are Buna-N, Neoprene, natural rubber, Hypalon and Teflon. Replacement



of seat rings can be accomplished without removing valve from line. Valve is available in bronze, aluminum bronze, and aluminum.

Worcester Valve Co., Inc.
Worcester, Mass.
Circle 183 on Reader Service Card

PILOT AIR VALVES
. . . with fewer parts

Features: Five new pilot valves are announced for hand, foot, palm-button, cam, and solenoid actuation. The hand valve is available in either locking or non-locking types. The valve may be used alone or in series for working pressures to 150 psi. The foot valve has generous

You get 10 big Integral-Motor-Pump advantages in these two NEW types (three models) of

GAST ROTARY AIR PUMPS

Model 0211
1/6 hp, to 1.3 cfm, 25 psi or 27" vac.

Model 0321
1/4 hp, to 2.2 cfm, 25 psi or 28" vac.

Model 0321
1/3 hp, to 3.8 cfm, 20 psi or 28" vac.

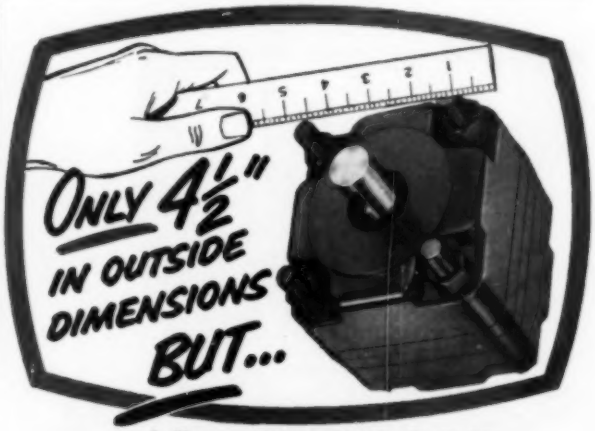
*0321 similar in appearance.

1. Latest type G.E. "Form G" motors.
2. More compact than other pumps.
3. Total weight reduced 1/3—cuts shipping costs.
4. Motor mounting time and labor eliminated.
5. Simple, trouble-free rotary-vane design.
6. Vanes take up their own wear automatically.
7. Positive displacement, pulseless air delivery.
8. Improved appearance—smoother exterior.
9. Dependable for original equipment; plant use.
10. Forced air fan cooling on Models 0321 & 0521.

Write for new Bulletins V-356 and P-356! **Gast Manufacturing Corp.** P. O. Box 117-D, Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY
• AIR MOTORS TO 4 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.
See Our Catalog in Sweet's Product Design File



delivers UP TO 12 G.P.M.

CHAR-LYNN 400 PUMP

UP TO 1500 P.S.I.
UP TO 2100 R.P.M.

This hydraulic pump is REVERSIBLE WITHOUT ALTERATION. The ⅞" dia. shaft (with ⅜" key) is housed in Anti-Friction bearings. The hardened steel precision gears (GEROTOR TYPE) are enclosed within an alloyed Die Cast Aluminum body. Mounting is directly on studs which can be reversed for mounting off back of pump. ¾" N.P.T. oil ports.

Write for FREE Catalog

CHAR-LYNN CO.
2843 26th Ave. So., Dept. AH7, Minneapolis 6, Minn.
Member—National Fluid Power Association

Circle 52 on Reader Service Card

Circle 29 on Reader Service Card

treadle area. The palm-button valve is especially suitable for panel mounting. Valve returns to normal position when button is released. Solenoid valve with instantaneous action has a cover which offers full protection against dust and dirt. Cam valve features a built-in overtravel which prevents damage when a series of cams operate the valve.

Mechanical Air Controls, Inc.
Detroit, Michigan
Circle 184 on Reader Service Card

FILTER-HEAT EXCHANGER
. . . for oil conditioning

Designation: CS

Features: Circulating system consists of pump, reservoir, filter, heat exchanger, and control valve. Com-

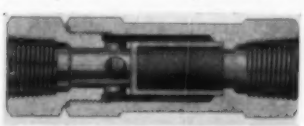
pact, inexpensive system is easily installed and provides important protection against downtime. Use of the auxiliary unit can prevent oil breakdown and consequent development of sludge and harmful deposits.

Bowser Technical Refrigeration
Terryville, Connecticut
Circle 185 on Reader Service Card

METAL FILTER
. . . 5-12 micron range

Designation: Micron-Filter

Features: Brass and stainless steel line filters are designed for use with any valve handling small flows,



if foreign dust or particles in the fluid stream tend to clog the throat, change the effective opening, or obstruct full closing of the valve. Replaceable filters are available in two female pipe sizes of ⅛ and ¼ inch.

Hoke, Inc.
Englewood, N. J.
Circle 186 on Reader Service Card

PRESSURE REGULATOR
. . . greater sensitivity

Designation: Type 3381

Features: Pressure reducing and

regulating valve has improvments including elimination of cap screws for easier maintenance and increased spring length for greater sensitivity and improved regulation. Unit can be supplied with pressure gage mounted in either of the two outlet connections. Adjusting screws are available with square head, plastic knob or wing nut.

Performance: Valve operates at inlet pressures to 400 psi at 150 degrees F and at 250 psi at 400 degrees F. Five spring ranges are available from 5 to 300 psi delivery pressure. Sizes are ¼ and ⅜ inch with screwed ends. ⅛-inch unit is available on special order.

A. W. Cash Co.
Decatur, Ill.
Circle 187 on Reader Service Card

ACCEPTED...
by the aircraft industry

Tubing Seal Cap's metal closures, for fourteen years, have been the accepted standard in protecting hydraulic lines and components during handling, shipping and storage.

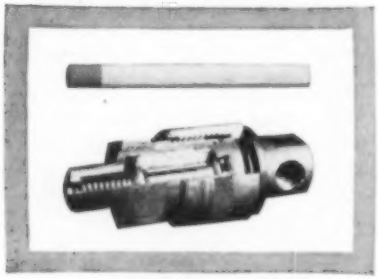
Send for REVISED ILLUSTRATED CATALOGUE and PRICE LIST

TUBING SEAL CAP, INC.
808 W. Santa Anita, San Gabriel, Calif.
Eastern Office
428 New Center Bldg., Detroit 2, Mich.

Circle 131 on Reader Service Card

Circle 70 on Reader Service Card

HUSCO
Hydraulic Controls are COST-SAVERS



Husco No. 4000 Rotary Swivel

This low cost, high efficiency Rotary Swivel is designed for both high pressure and high operating speeds in the brake and clutch field. Compact, for use in close quarters, it has spring-loaded Teflon rings, self-centering ball thrust bearing, highly efficient axial bearings. Size, only 3" x 1¼".

Check HUSCO *first* for experienced custom engineering in Hydraulic Controls—Valves, Cylinders, Pumps—on your new designs. Write for details.

HUSCO HYDRAULIC UNIT SPECIALTIES CO.
Pumps • Valves • Cylinders
Waukesha, Wis.

RUGGED, HEAVY-DUTY
HYDRAULIC CYLINDERS

Attention: O. E. M.
Prompt delivery on any quantity . . . high quality . . . low cost!

Built-in Mechanical Stroke Control

Free catalog and engineering survey, no obligation.

WRITE...PHONE...WIRE
CROSS MFG. CO.
LEWIS ■ PHONE 81 ■ KANSAS

Useful Literature continued

PUMP-MOTORS . . . Rotary gear units for outputs to 11.5 hp are described in two bulletins available from Geo. D. Roper Corp. Bulletin 22 illustrates the various units and indicates constructional features, sizes and capacities. Bulletin 26 describes the general features of the company's pump-motors, the factors of application, and gives dimensional data on each type. Charts are included to indicate input horsepower and gpm output as a function of speed for each unit as a pump. And input gpm and output horsepower for each unit as a motor. Numerous applications of the pump-motors are listed.

Circle 208 on Reader Service Card

LIMIT SWITCHES . . . form the subject of 28-page Catalog 83a released by Micro Switch Div. of Minneapolis-Honeywell Regulator Co. Covering general purpose, heavy duty, high capacity, splash-proof, and explosion-proof types, the catalog includes dimensional drawings and diagrams to show contact arrangement. The features and available modifications of each type of switch is clearly outlined. An introductory section of the catalog presents information on factors in selection of the proper limit switch and the choice of actuator design. The general purpose units are rated at 15 amperes ac and the heavy duty switches are rated for 20 amperes ac. A sheet indicating list prices and discounts is also included.

Circle 209 on Reader Service Card

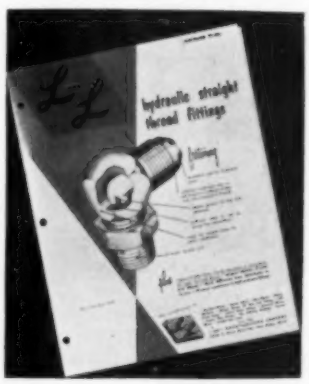
WHY USE A FLEXIBLE COUPLING? . . . is answered in the information section of Catalog No. 501 from American Flexible Coupling Co. The literature goes on to explain various types of misalignment, functions of a flexible coupling, and basic types of flexible couplings. Operating principles of two basic types of couplings are presented, and a page is devoted to information on the selection of flexible couplings based on shaft sizes, horsepower, speed, and space limitations. Sectional drawings of the company's products are included with dimensional specifications and indication of proper application. Constuctional features are pictured.

Circle 210 on Reader Service Card

TEFLON TUBING . . . of thin wall construction is presented in a brochure issued by Sparta Mfg. Co. The tubing, which is suggested for fuel return lines, high temperature lines and other applications, incorporates the qualities of Teflon tabulated in the brochure.

Circle 211 on Reader Service Card

STRAIGHT THREAD FITTINGS . . . featuring burnished seats for leakproof joints and radius corners for free flow passages are specified in Catalog ST-56 from L and L Manufacturing Co. Three



types of fittings including metal ring seal fittings, positive seal fittings, and O-ring fittings are included. Diagrams clearly illustrate the construction and installation of each type. In addition to complete dimensional data on the various styles of fittings, the catalog also contains information on O-rings for the fittings. These are available in Buna N, Neoprene, and Butyl.

Circle 212 on Reader Service Card

AIR VALVES AND NOZZLES . . . manufactured by Lunkenheimer Co. are described in a brochure from the company. Two-way manual valves for 150 psi are shown in sizes from ¼ to 2 inches. The safety valves are for pressures to 250 psi and to 400 psi. These have a ⅜-inch drain hole drilled in the bell. Air compressor check valves are illustrated with a hollow stainless steel disc for pressures to 300 psi. The design of the disc and bronze disc guide provides air-cushioning action which reduces pounding. A table is included in

Continued on page 144

Pumping Progress Report

FOR MECHANICAL ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

SPACE, in many pump installations, is a major problem. Another is the necessity for special foundations. When new installations are considered, these factors may dictate more elaborate construction than should be necessary. And for replacement or modifications of existing systems, they may require expensive piping and equipment changes.

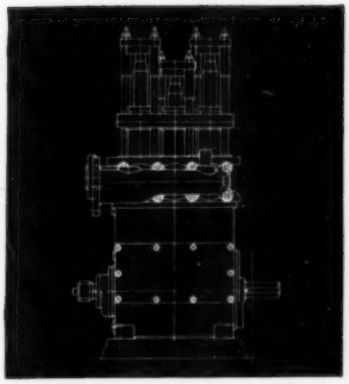
COMPACTNESS OF DESIGN, while often desirable, is not necessarily the answer. Simplicity of design — as in the case of ALDRICH Direct Flow Pumps — may be a better solution.

SIMPLICITY OF DESIGN brought about the first inverted Triplex and Quintuplex Pumps and ultimately Septuplex and Nonuplex Pumps. This Aldrich design innovation brought to pump users many economies of space, maintenance and operation they had never known.

INVERTED PUMP DESIGN permits the use of less expensive foundations. With the crankshaft located near the floor there is no need for expensive foundation work to raise the driver or lower the pump. Then, too, inverted pumps require fewer square feet of floor space than conventional pumps.

MAINTENANCE COSTS ARE REDUCED. Fluid-end, where most work is done, is at chest level. Bearing replacements are made without removing heavy crankshafts or connecting rods. Crossheads on all Direct Flow Pumps can be worked on or removed from pump without disturbing fluid-end.

TELL US ABOUT YOUR PUMPING PROBLEM. The chances are that one of our standard pumps — or a modification of one — will do your job. Detail your problem and we'll send you a copy of the Data Sheet that describes the Direct Flow Pump we recommend. Write to: The Aldrich Pump Company, 14 Gordon Street, Allentown, Pa.



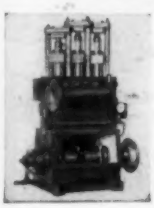
Aldrich inverted vertical pump design

...for your tough pumping problems specify ALDRICH

The entire line of Aldrich Direct Flow Pumps feature two outstanding design innovations—inverted vertical design and sectionalized fluid-ends. These two features have helped make Aldrich the organization hydraulic engineers turn to when they face tough pumping problems. If you have a pumping problem, turn it over to the men who have never turned down a challenge.

CHECK THESE ADVANTAGES OF INVERTED PUMP DESIGN:

Smaller Foundations
Simpler connection with prime mover
Less floor space required
Reduced maintenance costs



Write today for Data Sheets describing the Direct Flow Pump Series.

THE ALDRICH PUMP COMPANY

Originators of the Direct Flow Pump
14 GORDON STREET
ALLENTOWN, PA.
Representatives in principal cities

Useful Literature continued

the brochure to point out the cost of air leaks. The number of cubic feet per month which is lost through various size holes is shown with the total cost of this wasted air.

Circle 213 on Reader Service Card

TUBING . . . The story of how tubing takes shape is told in a brochure prepared by The Wallingford Steel Co. manufacturers of pipe and tubing for aircraft and pressure applications as well as other uses. Photographs show the various phases of processing, quality control, and development. The stages in processing welded tubing is shown in a diagram, as is the process of cold drawing tubing. Standard tubing is produced with OD's from .250 inch with a wall thickness of .007 to .049 inch, to 3 inches with wall thicknesses of .035 to .148 inch. The aircraft tubing covers a wide range of applications including small hydraulic lines.

Circle 214 on Reader Service Card

SPLIT-FLANGE COUPLING . . . Anchor Coupling Co. Catalog No. 400 describes the 4-bolt, split-flange coupling for high, medium, low and suction return applications. The coupling employs an O-ring seal and eliminates thread compounds, spiral leaks, and wedging of pump or valve bodies by tapered pipe threads. Use of thinner sections on valve and pump bosses are permitted with a saving in weight and cost. Separate union and swivel connections are eliminated, and short, stiff assemblies may be used because there is no deflection or twisting of hose in the make-up of a joint.

Circle 215 on Reader Service Card

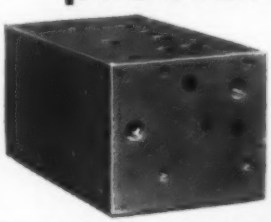
2-WAY SOLENOID VALVE . . . with a straight-through port construction and threaded connections for ¼, ⅜, and ½-inch tubing is described in a data sheet issued by Aircraft Products Co. The sheet lists complete specifications on the new Series 6100 and 6200 shut-off valve for 3000-psi hydraulic service. Included in the data sheet is a dimensional diagram and a performance graph showing pressure drop vs flow for four models of the valve. The valve design employs a fully balanced inverse poppet which allows for a wide range of flows and pressures in any direction without affecting its operating characteristics. The internal flow configuration is such that the dynamic effect of th eflow is minimized.

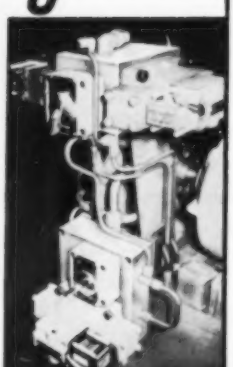
Circle 216 on Reader Service Card

ROLLER BEARINGS . . . which have a self-aligning design are detailed in Book 2658 from Link-Belt Co. Features of the bearings are described and instructions for the selection of the proper bearing are presented with five examples. Complete specifications for the three available styles are included. The bearings permit full load-carrying capacity without auxiliary provisions, regardless of shaft deflection or misalignment. The spherical inner raceway is free to move in any direction without altering roller contact. The load is properly distributed over the length of the rollers and the rollers are always aligned.

Circle 217 on Reader Service Card

Your manifold problems Solved





We are Drilled Manifold Specialists! We can manufacture to your specifications . . . or design special manifolds to fit your needs.

Will accommodate from ⅛" to 1½" valves.

Drilled manifolds of solid ground steel offer such advantages as:

- LOWER COST
- COMPLETELY LEAK-FREE
- MORE COMPACT
- BETTER APPEARANCE
- EASY VALVE SERVICING

Send for FREE Booklet

Birmingham Hydraulic

DRILLED MANIFOLDS 14253 W. 11 Mile Rd.—Oak Park, Mich.

THERE IS NO SUBSTITUTE FOR LONG-LASTING....

● Only *Plastic Lead Seal assures you a seal that will last as long as the connection itself. It is ideal for water, oil, gas, steam, refrigerants, chemicals and petroleum products at temperatures as high as 500°F., pressures to 6000 psi.

Because PLS remains plastic at all times, it gives permament assurance against leakers—regardless of vibration, expansion or contraction—yet permits easy disassembly of connections, even after years of service.

It's economical to use PLS on pipe joints, plugs, screwed fittings, flanges and gaskets—because it takes less to make a perfect seal.

PLS is easy to apply . . . and it's easy to try! Just send for a free sample.

Available in 1-lb. cans (brush top or friction), 4-oz. plastic tubes, 5-lb. cans, 15 and 28-lb. pails and 85-lb. drums.

6405 Oakton Street, Morton Grove, Illinois, (Chicago Suburb). In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

John Crane — MECHANICAL PACKINGS · SHAFT SEALS · TEFLON PRODUCTS · LAPPING MACHINES · THREAD COMPOUNDS

CRANE PACKING COMPANY

Circle 21 on Reader Service Card

Circle 33 on Reader Service Card

GAGES . . . Norden-Ketay Corp. has issued Bulletin No. 364 to specify their line of gages for pressures to 20,000 psi. These units feature bourdon tubes of phosphor bronze, alloy steel, stainless steel, or K-monel. Connections are ¼-inch male on gages to 1000 psi and ½-inch male on gages from 1000 to 20,000 psi. The gages have solid front cases with full-area blow out disk in the back. Accuracy of the units is within ½% of the scale range, and a pulsation dampener produces positive dampening when used in conjunction with a slotted link. A capillary bleeder permits complete filling of the gage without using equipment for evacuation of the bourdon tube.

Circle 218 on Reader Service Card

CORED FORGINGS . . . A new production method which produces parts with maximum strength and saves material, weight, machining time, and production cost is outlined in Publication AB-1001 from The Weatherhead Co., Aviation Div. Parts which can be effectively produced by the process are illustrated in the pamphlet and the advantages of the manufacturing method is presented. Cored forgings are made on special presses. The operation differs from solid forging in that the pressure is created within a closed die by movable coring punches. The result is a higher strength forging, die casting accuracy, dense uniform grain structure, no porosity or flaws, use of less metal, and less machining required. Fittings made by this process have successfully undergone severe hydraulic tests.

Circle 219 on Reader Service Card

HOSE CLAMP . . . made from a single piece of metal is outlined in a brochure from Circle Clamp Corp. The publication shows applications of the clamp, including hydraulic fluid lines, and indicates that tests showed no slippage or loss of clamping action when the clamps were used on wire braided hose at 12,000 psi. In addition, the clamps simplify mounting and dismounting and offer a lower initial cost than many other types. A wide range of sizes is available.

Circle 220 on Reader Service Card

AIRCRAFT HYDRAULIC COMPONENTS . . . manufactured by Houdaille Aviation are outlined in a pamphlet from the company. These products include accumulators, valves, cylinders, and reservoirs and special components for particular jobs. A typical aircraft hydraulic system is diagrammed to indicate the extensive application of hydraulic equipment for aircraft. Special parts which have been produced by the company include shuttle valve assemblies, landing gear operating cylinders, arresting hook actuators, and radar antenna actuators.

Circle 221 on Reader Service Card

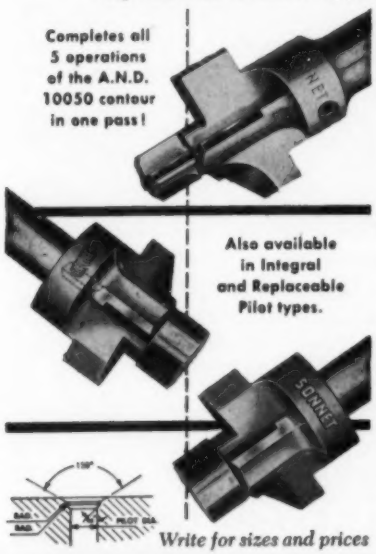
MAXIMUM ALLOWABLE STRESS VALUES . . . for seamless and welded carbon, alloy, and stainless steel tubing and pipe is the title of Technical Data Card 154 as prepared by Tubular Products Div., Babcock & Wilcox Co. The card presents formulas for calculating minimum thickness of tube wall and maximum allowable working pressure for tubing and pipe. A table presents maximum allowable stress values for ferrous pipe and tubing in psi. Explanatory notes discuss the use of tubing at elevated temperatures and pressures.

Circle 222 on Reader Service Card

Continued on next page

Sonnet A.N.D. 10050 Port Contour Cutter

now available in a NEW Replaceable Reamer Type


Completes all 5 operations of the A.N.D. 10050 contour in one pass!
Also available in Integral and Replaceable Pilot types.
SONNET

Write for sizes and prices

SONNET TOOL and MFG. CO.
571 No. Prairie Avenue • Hawthorne, California

Circle 119 on Reader Service Card

HYDRAULIC CYLINDERS

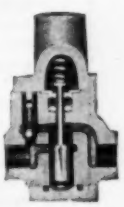
CUSTOM-DESIGNED

by B.H.E.W.

Meet Your Product-Design Requirements.

Dependable performance in minimum mounting space is characteristic of B H E W hydraulic cylinders. Standard and special O.E.M. designs of all types, sizes and any mounting style are available on order . . . delivered on schedule.

Send specifications of your requirements for ANY kind of hydraulic, pneumatic and water cylinder.



BHEW

Lift trucks need the B H E W Pressure-Operated Hydraulic Flow Control Valve. It eliminates surge as load starts down. Load-weight controls rate of descent.

Benton Harbor Engineering Works, Inc.

St. Joseph, Michigan

Circle 20 on Reader Service Card

Useful Literature continued

FLOW METERS . . . for various applications are discussed in Bulletin 130 from Brooks Rotameter Co. Principles of construction and operation are given and performance specifications are also indicated. The bulletin includes information on the Model 3632 unit for pressures to 5000 psi at 200 degrees F and flow rates to 60 gpm water. The meter body is made of cold rolled bar stock, stud bolted using flat or O-ring gasket seals between the meter body and extenison. Standard indicating extensions can be supplied for pressures to 1000 psi or special extensions can be supplied for higher pressures.

Circle 223 on Reader Service Card

AIR PRESSURE REGULATOR . . . in which the main valving mechanism is indirectly actuated by a separate valve motor is detailed in a booklet produced by Governaire Div. Bellofram Corp. In addition to a schematic drawing and discussion explaining the operating principles of the unit, the booklet illustrates and specifies each model. A section of the booklet is devoted to graphs and tables to indicate performance of the various models. These graphs show forward and exhaust flow for various settings of the pressure regulator and supply pressures. Charts for each model valve indicate remote volume charge and exhaust times, and maximum practical flow capacity at various pressure settings and supply pressures.

Circle 224 on Reader Service Card

STAINLESS TUBING . . . for heat exchanger and condenser tubes is discussed in a brochure released by the Steel & Tubes Div., Republic Steel. Photographs and text describe the process, manufacture, chemical composition, and analysis of this tubing. Means by which the tubing is made to incorporate uniformity in surface, size, ductility, strength and concentricity are also described in the brochure. The stainless steel tubes conform or exceed all conditions of ASTM Specifications A-249 and A-269, which apply to welded Autsenitic stainless steel heat exchanger and condenser tubes.

Circle 225 on Reader Service Card

FLEXIBLE COUPLINGS . . . which have been developed for 4000 psi systems with wider range of operating fluids, ambient temperature ranges, and use of synthetic lubricating and fire resistant fluids are discussed in a booklet published by Avica Equipment Ltd. Covering the design, performance, installation and size ranges of the units, the booklet includes tables to show performance characteristics of torque at various temperatures and results of pressure drop tests. Typical units in ¼, ½, and ⅜-inch sizes are illustrated, and a design using rotating arms is also shown.

Circle 226 on Reader Service Card

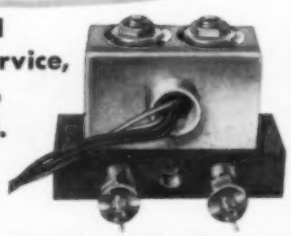
"MOTORS AND DRIVES . . . for The Machine Tool Industry" outlines the many different types

Continued on page 148

Modernair

NEW ¼" SOLENOID VALVE

for Air or Oil Hydraulic Service, 30 to 150 p.s.i.



★ ULTRA COMPACT...only 4-9/16" long, 3-5/16" high, 1-3/4" wide overall!
★ NON-CORROSIVE CONSTRUCTION...brass and aluminum throughout.
★ "O" RING SEALS...replaceable without disturbing piping.
★ AVAILABLE IN SINGLE OR DOUBLE SOLENOID for all popular a.c. or d.c. voltages.
★ 3-WAY (3 port) OR 4-Way (5-port) MODELS, with or without exhaust speed control valves as shown. Standard ports are female 1/4" NPT.

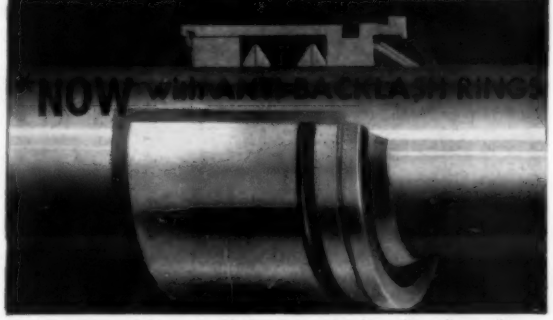
MODERNAIR's new BV Series ¼" solenoids put the answer to scores of fluid power control problems literally in the palm of your hand. Why not get the facts now? Write or wire for specifications, prices.

Modernair CORPORATION

Dept. B-7, 400 PRETA ST., SAN LEANDRO, CALIF.
Member National Fluid Power Association 20

Circle 90 on Reader Service Card

THE ORIGINAL
MONOPAK—CARTRIDGE



A complete packing unit for hydraulic or pneumatic rods or cylinders.

*Detailed literature on request.

- Easily installed or replaced.
- Needs no adjusting.
- Reduces initial machining expense.
- Longer service life.
- Includes "Seal-Guard" rod wiper.
- Low friction coefficient.
- Shock and burst proof.
- Cuts machine down-time.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

Circle 67 on Reader Service Card

Circle 122 on Reader Service Card

If your equipment or process requires . . .

ACCURATE, AUTOMATIC TEMPERATURE CONTROL

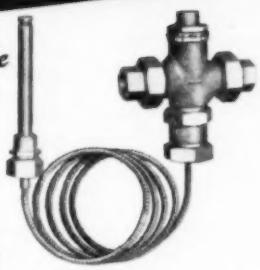
for HEATING or COOLING (using STEAM, WATER, or HEAT TRANSFER FLUIDS)

There is no equal to the

Sterlco®

Series 150-E

TEMPERATURE CONTROL VALVE



Here is a quality, dependable, and low cost self-actuated automatic modulating control valve. It's compact, self-contained; and, as part of your equipment or process, will eliminate the human factor of manual valves. Balanced single-seated construction eliminates effect of pressure variation. Send for Bulletin #505.

MOUNTS *and* **OPERATES** *in* **ANY POSITION**

INDUSTRIAL CONTROL DIVISION
STERLING, INC.
3742 N. Holton Street • Milwaukee 12, Wis.

Clamp Hydraulically and Slash Fabrication Costs!

Simple Units
Inexpensive
Equal Pressure at all Points
No Distortion
Instant Clamp Release

NEWTON TRADE PRODUCT MARK
CLAMP
Hydraulic **MULTIPOINT**

For MILLING
GRINDING
WELDING
GLUEING
and every other clamping problem

A NEWTON PRODUCT

Please send for Publication No. F/243

POWER JACKS *LIMITED*
VALETTA RD. · ACTON · LONDON · W3

Telephone: Shepherds Bush 3443/6 Telegrams: Newsorber, Ealux, London

UNITED ELECTRIC
Multi-Purpose
PRESSURE CONTROLS J7 | J40

Enclosed-TYPE J7

Skeleton-TYPE J40

These controls are compact, precision-built, rugged and inexpensive. Type J7 is ideal for controlling air, gas or liquid pressures up to 500 psi . . . Type J40 for pressures up to 250 psi.

Adjustable Pressure Ranges	J7 . . . various models cover ranges between limits of 0 and 500 psi J40 . . . various models cover ranges between limits of 0 and 250 psi
Switch Ratings	15 amps or 20 amps at 115 or 230 volts A.C., also D.C. switches upon specification
Switch Types	N.C., N.O., or Double throw, no neutral position
Electrical Connections	J7 . . . screw type terminals on switch standard J40 . . . solder type terminals on switch standard
On-Off Switch Differential	Fixed and uniform throughout specified range is standard
Mounting	J7 . . . ¼" NPT female, brass fitting standard J40 . . . ⅛" NPT male, brass fitting standard
Variations	Design variations are available upon specification
Applications	On industrial equipment and engine applications . . . marine, aircraft or special purpose

Although **UNITED ELECTRIC** *offers a complete line of temperature, pressure and vacuum controls . . . UE application engineers specialize in solving unique problems.*

Send for full particulars today. Bulletins available upon request. Type J7 . . . Bulletin No. 5-7, Type J40 . . . Bulletin No. 5-9

U.E.
United Electric Controls
COMPANY
SCHOOL STREET, WATERTOWN, MASS.

Useful Literature continued

of motors, high frequency supplies, and adjustable speed drives especially applicable to machine tools. Special motors include such types as special shafts and flanges, special mechanical construction, rolled shell shaftless motors, and units incorporating plugging switches and brakes. The booklet prepared by The Louis Allis Co. and designated Bulletin 1750 contains graphs of torque vs speed for multispeed motors which often fill the gap between constant speed induction motors and adjustable speed drives. Graphs also indicate special electrical characteristics or torque, slip, inrush current, etc. that can be designed into special motors. In addition to the standard open dripproof, totally enclosed, fan cooled and gearmotors, the bulletin contains information on torque motors and electronically controlled adjustable speed drives. Many machine tool applications are illustrated.

Circle 227 on Reader Service Card

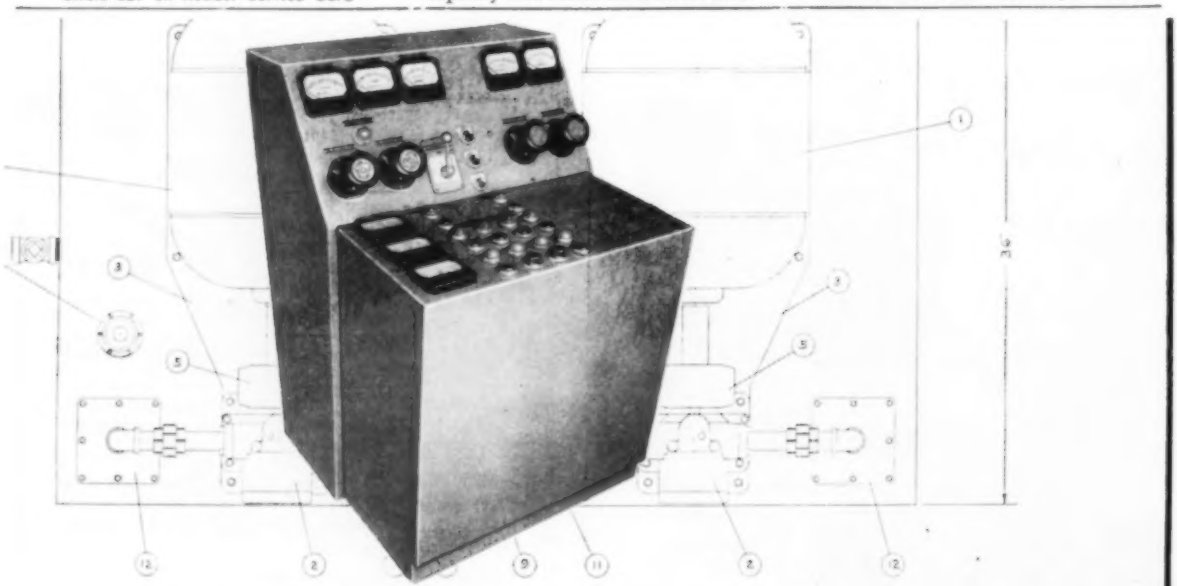
ROTARY SWITCH . . . which may consist of 1 to 30 individual switch sections assembled on a shaft is described in Catalog 5501 published by Electro Switch Corp. The catalog describes and illustrates the various shapes of standard rotors, contacts, slip rings and star wheels that can be assembled in a variety of arrangements to control electrical circuits in any specified sequence. Various assemblies are diagrammed, and specifications and ordering information are presented.

Circle 228 on Reader Service Card

HYDRAULIC POWER UNITS . . . and mill type air and hydraulic cylinders are the subjects of Catalogs 4-55, and C-156 respectively. The catalogs describe features and present specifications on products designed and produced by Hydraulic Power Equipment Co. The custom designed power units have a generous ratio between the pump capacity and reservoir size. In most cases this eliminates the need for heat exchangers. In the mill type, heavy duty power units, the pumps are mounted below oil level, so that the intakes are continuously flooded and not dependent on suction lift capacity. Complete dimensions are given for the 1500-psi hydraulic and 200-psi air cylinders for rod-end flange mounting, blank-end flange mounting trunnion, clevis, or foot mounting. Rotating cylinders developed for actuation of mandrel drum expanders on payoff and tension reels are also described.

Circle 229 on Reader Service Card

NEW COMPOUND . . . called Disogrin is announced by Greer Industries in a recently issued brochure. The synthetic material has outstanding tensile strength and unusual resistance to oil, fuel, abrasion, and aging. The material can be either compression-injection molded or liquid cast. The material may be bonded to metals by special processes. Tables included in the brochure indicate the various properties of the material; comparative fluid resistance between Disogrin and other synthetic materials; resistance to certain solvents; and re-



DC Drive Speed Control Station
With Auxiliary AC Motor-Control
And Operators Push Button Section

APPLICATION:
Paper Making Machinery

The **CARDWELL MACHINE COMPANY**
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593

REVISIONS	THE CARDWELL MACHINE CO. RICHMOND, VA.		
	CARDWELL SPECIAL ELECTRICAL CONTROL CONSOLE		
	DATE 5-9-56	DWN. BY H.L.W.	2722-4
	CHK. BY C.L.M.	SCALE 3/8" = 1'-0"	

sistance to certain fluids. Parts which have been successfully produced from the material include accumulator bladers, O-rings, metal-reinforced scrapers, valve seals, bellows, and check valve buttons.

Circle 230 on Reader Service Card

PISTON RINGS . . . are included in a booklet published by France Packing Co. In addition to the company's line of packings for compressors, steam, and gas engines, many different types of piston rings are illustrated and discussed. These types include bronze segmental rings, tensioned carbon-bakelite rings, heat tensioned rings, chrome plated rings, and Teflon rings which are especially recommended for hydraulic cylinders. Also included in the booklet is a guide for selecting packing ring materials detailing the properties of cast iron, bronze, babbitt, carbon-bakelite and carbon rings.

Circle 231 on Reader Service Card

TIME DELAY RELAYS . . . for special aircraft applications are presented in a brochure from M. H. Rhodes, Inc. Several of the solenoid-wound, spring-driven models are illustrated with descriptive information outlining the features and operation. Delay periods may be obtained in ranges of .25 second to 15 minutes with a tolerance of ±20% in the temperature range from −76 to +131 degrees F. The switches may be furnished as DPDT, SPDT, or SPST. Included in the brochure is one model which is wound practically instantaneously as the control circuit is energized. A descriptive sheet is also included to specify two models of spring-operated timing devices. Time ranges are available from 5 seconds to 5 minutes and from 5 seconds to 60 minutes on these units.

Circle 232 on Reader Service Card

HOSE COUPLERS . . . are outlined in a data sheet from Ulrich Manufacturing Co. Two models are shown, one of which can be used with a breakaway bracket which guards against damage to hydraulic lines and loss of hydraulic fluid. The couplers incorporate spring-loaded ball check valves with a positive lock to hold the balls in perfect alignment assuring a full flow of hydraulic fluid. A bayonet type sleeve lock guards against random disconnect.

Circle 233 on Reader Service Card

FILTERS . . . employing the principle of surface filtration are described in bulletin 515 from Sparkler Mfg. Co. The filter paper is available in selective grades of porosity, so that the fineness of filtering can be controlled by using the grade of paper suitable to the job. The purity of the filtered oil continues constantly throughout the filtering cycle. As the filter approaches the stage where cleaning is necessary, the quality of the filtered oil continues the same—only the flow rate is reduced. Shown in the bulletin are the steps necessary to change paper filters. A small unit for installation on hydraulic machinery using high fluid pressures to 500 psi is shown, as well as a portable unit for flow rates from 5.3 to 84 gpm.

Circle 234 on Reader Service Card

PACKINGS . . . in various forms are illustrated and described in a 48-page catalog prepared by The Allpax Co., Inc. The catalog is divided into sections treating general service packing, special service packing, and sheet packing. A section is also devoted to other products of the company including gasket cutters, gasket removers, and

Continued on next page

Backed by more than a century's experience

BRITISH

Hydraulic Plant & Equipment LEAD THE WORLD

Particulars of Members and their Products will appear in a future announcement.

The Hydraulic Association of Great Britain

•

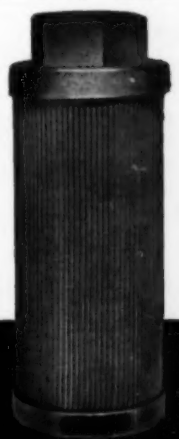
94/98 Petty France, London, S.W.1. England
Telephone: Abbey 1845.

•

Cables: Crusade, Sowest, London

Circle 68 on Reader Service Card

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH



The New

CAPITAL HYDRAULIC OIL FILTER

WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

Circle 24 on Reader Service Card

Useful Literature continued

asbestos tape. Included in the section on special packing is a hydraulic packing which is made from white cotton duck with a semi-metallic hydraulic packing for service to 10,000 psi. The packing is manufactured from a cloth interwoven with fine, hard twisted flax yarns and strands of antifriction metal wires to produce the desired flexibility and tensile strength.

Circle 235 on Reader Service Card

SCREW TYPE PUMPS . . . for pressures to 500 psi are the subject of Catalog LS published by De Laval Steam Turbine Co. The pumps have a constant displacement design with three screws with thread surfaces forming a tight seal relative to each other and to the surrounding housing. The pumps, designated IMO, are quiet in operation because of the natural, smooth rolling action of the cooperating screws, elimination of timing gears, and absence of hydraulic hammer. In addition to complete dimensional specifications for each model, the material shows cutaway views and details design features. Performance data lists BHP at various pressures as well as maximum pressures and capacities.

Cricle 236 on Reader Service Card

"RUBBER COMPOUNDING . . . and Molding" is the title of Bulletin C-55 which outlines the facilities of Colonial Rubber Co. The booklet indicates research facilities, mold production, quality control, and products. Among the products is a large rubber ring seal for steel pipe carrying water at 3500 psi. These seals are made from a special compound developed by the company.

Circle 237 on Reader Service Card

MINIATURE SHAFT COUPLINGS . . . In Bulletin MC-100, Thomas Flexible Coupling Co. has outlined its couplings for servomechanisms, computers, and other small devices. The couplings are for speeds to 50,000 rpm, are light weight, and have low inertia. The units range from a torque capacity of 3.1 in-lb with a wegiht of .67 oz to a torque capacity of 60 in-lb with a minimum weight of 3.89 oz. The couplings have freedom from backlash with torsional rigidity, free end float, and smooth continuous drive with constant rotational velocity.

Circle 238 on Reader Service Card

O-RING LUBRICANT . . . especially recommended for low-pressure air systems is described in Catalog 5840 issued by Parker Appliance Co. The grease is applied to both the O-ring and the metal surfaces over which the O-ring must slide. After original assembly lubrication, additional application normally is not necessary. Other compounds featured in the catalog include an anti-sieze and sealing compound which forms a flexible, vibration-proof seal for threaded joints that is easy to disconnect. It may be used to form a gasket or to make any gasket seal better. The catalog also shows an anti-sieze compound for fuel or oil system parts of aluminum.

Circle 239 on Reader Service Card

it's NEW!
5/8 INCH BORE
AIR-OIL CYLINDER
If you've been using 1" or larger bore cylinders for those applications in which you wanted the "smallest" bore, here are some of the benefits you'll derive from the new AIROYAL ⅝" bore cylinder: more compact size; reduced thrust from a given pressure; lower piston and rod inertia; increased velocity from a given flow input.
Cylinders are available single and double acting in all mounting styles. And you'll appreciate the low price—only $28.00 list for pressures to 750 PSI, $32.00 for pressures to 1500 PSI.
MANUFACTURED BY
THE AIROYAL CO
1990 SPRINGFIELD AVENUE
MAPLEWOOD, N. J.
REPRESENTATIVES IN PRINCIPAL CITIES

Circle 5 on Reader Service Card

Circle 53 on Reader Service Card

WE'RE CROWING ABOUT OUR HYDRAULIC CYLINDERS - CUSTOM BUILT AT MASS PROD. PRICES

SAVE 50%

Our 10 Years of experience filling the needs of Aircraft and Heavy Industry have led to the development of these outstanding Industrial Hydraulic Cylinders. All are Double Action with rugged steel construction throughout. Made to stand pressure up to 1500 PSI and 3000 PSI. Utilizing standard 'O' rings with leather back-up rings on 3000 PSI types. Male clevis mounts on both ends of the Cylinder. Write us Today for further information. We also Custom Manufacture to YOUR SPECIFICATIONS.

PART NO.	BORE	SHAFT	STROKE	LENGTH	Type of CAP	P.S.I.	THRUST	PRICE
P3-4-15E 3	3"	1-1/8"	4	9¼"	External	1500	10,500 LBS.	$34.25
P3-6-15E	3"	1-1/8"	6"	11¾"	"	1500	"	36.75
P3-8-15E	3"	1-1/8"	8"	13½"	"	1500	"	39.50
P3-12-15E	3"	1-1/8"	12"	17½"	"	1500	"	44.75
P4-5-15E	4"	1-1/8"	5"	10¾"	"	1500	18,750 LBS.	39.50
P4-6-15E	4"	1-1/8"	6"	11¾"	"	1500	"	41.50
P4-8-15E	4"	1-1/8"	8"	13¾"	"	1500	"	45.75
P4-10-15E	4"	1-1/8"	10"	15¾"	"	1500	"	50.00
P4-12-15E	4"	1-1/8"	12"	17¾"	"	1500	"	54.00
P4-5-30E	4"	1-1/2"	5"	10¾"	"	3000	37,500 LBS.	55.25
P4-6-30E	4"	1-1/2"	6"	11¾"	"	3000	"	57.25
P4-8-30E	4"	1-1/2"	8"	13¾"	"	3000	"	61.50
P4-10-30E	4"	1-1/2"	10	15¾	"	3000	"	65.75
P4-12-30E	4"	1-1/2"	12"	17¾"	"	3000	"	69.75
INSERTED CAP TYPE								
P3-4-15-1	3"	1-1/8"	4"	11½"	Inserted	1500	10,500 LBS.	34.25
P3-8-15-1	3"	1-1/8"	8"	17½"	"	1500	"	39.50
P5-12-30-1	5"	2"	12"	21½"	"	3000	59,250 LBS.	85.00
P5-18-30-1	5"	2"	18"	27½"	"	3000	"	97.50
P5-24-30-1	5"	2"	24"	33½"	"	3000	"	115.00
P5-30-30-1	5"	2"	30"	39½"	"	3000	"	135.00

EXTERNAL CAP TYPE

INSERTED CAP TYPE

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

NEW

Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW - HEAVY DUTY HYDRAULIC CYLINDER

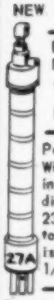
A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore, 13" stroke, 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds **95.00**

SAVE UP TO 85% ON GOV'T SURPLUS HYDRAULICS

SURPLUS HYD. CYLINDERS

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.

NEW **43.95** USED **29.95**



Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29¾". Ports 3/8" AN pipe. **35.77**

Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Ports are 1/2" AN pipe. **45.00**

Part No. 27C – Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**

180° OFFSET DRIVE

For use where tremendous power at a low take-off RPM is desired. Has 6 gears rotating on self-lubricating, hi-speed roller bearings. 85 to 1 gear ratio. Shafts are 1/4" and 3/8" in diameter. USED . **5.95** NEW – in excellent condition. **8.95**

HYD. HOSE & TUBING

We stock a complete line of Hydraulic Tubing and Hose as well as all types of fittings and hardware. Send us your requirements.

TELESCOPING HYDRAULIC CYLINDER

Thrust shaft is in two stages. First stage extends 39" – the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3¼" dia. Bore is 4¼". Ports are 1/2" AN pipe. **165.00**

10,000 PSI HAND PUMP AND RESERVOIR **19.75**

For use with a short stroke press or as a static pressure booster pump. Reservoir mounts vertically with a capacity of 45 cu. inches. Has two position handle. . .

HYDRAULIC HAND PUMP – Has 1500 PSI operating pressure. 1.5 cu. inch capacity per complete cycle. Top condition. **12.75**

4-WAY BANK VALVE

A Bank Valve containing four 4-way poppet type valves. Complete unit has a common inlet and outlet with a built-in relief valve and metering valve. The 4-way valves are independently controlled – pressure balanced with a neutral position. Ports are 3/8" AC tube (9/16"-20 thread **22.50**

SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS

Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

Part No.	Cu. in. per rev.	GPM	PSI	RPM	PRICES NEW	PRICES USED
HYDRAULIC PUMPS						
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000		$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF10-713-30B	.600	9.75	1000	3750	$57.50	—
MF9-713-25BCF	.507	8.25	1000	3750		$22.50

STRATO POWER HYDRAULIC PUMPS

Designed and built to finest aircraft specifications.

PART NO.	GPM	PSI	RPM	PRICE EA.
SP-3	2	1400	3750	NEW $27.50
P3C	20	1500	3750	NEW $125.00

Order from this Ad. Pay by Money Order or Check. P.O.s accepted from well rated D&B firms. 1/2 Dep. with C.O.D.s. Prices F.O.B.

VICKERS AA20328 HIGH PRES. PUMP

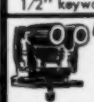
Automatic, variable volume of 1850 to 2000 PSI continuous operating pressure. Has a continuous speed of 3750 RPM maximum. Displacement is .600 cu. in per rev. Will deliver up to 9.2 gallons per min. at 3750 RPM. Rotates right hand only. Will operate in any position, but top case drain must be connected to reservoir. Reservoir must be pressurized. Ports are 1" AN inlet and 5/8" AN outlet. . . . . ONLY **129.00**

SURPLUS VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **49.50**

4" SPLINE SHAFTS for input and power take-off on above. **$2.50 pair**

INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**



PESCO HYD. PUMP

A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI – delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

NEW HYDRAULIC CATALOG

Showing our Complete line of New and Surplus Hydraulic Supplies and Equip Includes Cylinders in 106 sizes and types. All types Valves, Fittings, Pumps, Hyd. Motors, etc. Write TODAY!

Palley SUPPLY CO.

2263 E. VERNON AVE., DEPT. AH-7 LOS ANGELES 58, CALIFORNIA

Post Scripts of Industry

News about people, manufacturers and sales organizations

David J. Munroe
Webster Electric Co.

John A. Marsh
Rivett Latch & Grinder, Inc.

John V. Gregory
Barksdale Valves

Webster Electric Company announced the following new appointments: **David J. Munroe** was named president. He succeeds **Preston G. Crewe** who has filled the newly created post as vice chairman of the board of directors. **Arthur C. Kleckner** was re-elected chairman of the board. **J. O. Mithus** was promoted to the combined post of secretary-treasurer and **O. F. Hansche** was appointed assistant secretary.

Sales manager of the Air & Hydraulic Division, **John A. Marsh** has been named vice president in charge of sales by **Rivett Lathe & Grinder, Inc.** His experience in air and hydraulics dates back to 1942 when he was associated with Logansport Machine Co., and later with the Gerotor May Corp. Marsh is a director of the National Fluid Power Association, which he helped to organize.

Aero-Coupling Corporation, a subsidiary of Aeroquip Corporation, recently opened a subsidiary plant to provide facilities for forming, brazing and welding tubular components for aircraft and industrial plumbing.

Promotion of **John V. Gregory** to manager of the New Jersey office of **Barksdale Valves** has been announced. Prior to his promotion, Gregory served as salesman for the northern New Jersey area. He was previously associated with Bendix Aviation and Air & Hydraulics Equipment Co.

John J. Intintolo has joined **CDC Control Services, Inc.,** as project engineer in its new Aviation Division. A graduate from Villanova University, Intintolo has wide experience in design and development of fuel metering and automatic control systems for turbo-jet engines.

Ledeen, Inc., has started construction on their new headquarters at North Gilman Road, El Monte, Calif. The building will cover an approximate area of 30,000 square feet, will consist of offices, machine shop and warehouse. The new facility will also serve as headquarters for their subsidiary **Engineering Products Co.**

Charles L. Holbert has been appointed executive vice president of **H. K. Porter Company, Inc.,** to succeed Clarence R. Dobson, who has retired. Dobson, with Porter since 1946, will serve as a consultant. Holbert was previously executive vice president of the Southern Pacific Milling Co.

Several changes in the sales organization of **Minnesota Rubber and Gasket Company** have been announced. **Richard K. Mattocks** has been named assistant national sales manager, a newly created post. **Robert Wilson** is now district manager in the New York area, assisted by **Eugene Fischer.** The Cleveland office, directed by **William Grotenrath,** has been extended to cover Cincinnati and will be serviced by

Continued on page 154

Circle 28 on Reader Service Card

What a sight!

CENTURY'S

All-new Oil Level Sight Gage

- No Easier Installation Ever Designed
- Better Visibility at any Height
- Leak-proof—No Dripping
- Streamlined Modern Appearance
- Important Savings in COST
- Available NOW From STOCK

Inquire today . . . make immediate use of the sensational advantages in cost and services offered by this new gage . . .

CENTURY HYDRAULICS, INC.
7701 LYNDON AVE. • DETROIT 38, MICHIGAN
Telephone: DIAMOND 1-3797

New

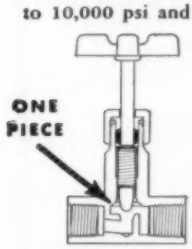
MARSH

Needle Valves

MAXIMUM WORKING PRESSURE 10,000 PSI

. . . for finer regulation of water, oil or gas

First needle valve to combine all the characteristics called for in modern industry. Embodies sturdiest basic construction—machined from solid bar stock—suitable for pressures to 10,000 psi and equally efficient in lower range. Note stem guide fused to body by new "Conoweld" process, eliminating faults of conventional two-piece valves. Stem 416 stainless steel. Stem threads fine pitch for strength and micrometer regulation. Body electro-zinc plated. Sizes ⅛" to 1", globe and angle patterns.



Ask for new Needle Valve Catalog

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corp.* Dpt. 19, Skokie, Ill.
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd Street, Edmonton, Alberta, Canada

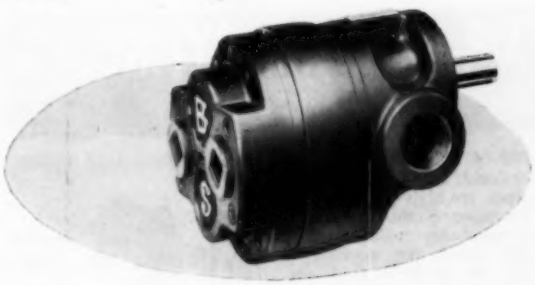
Circle 85 on Reader Service Card

For top performance under pressure

...8 Pumps for Your Hydraulic Systems

Nos. 53 and 55 for Pressures to 200 psi
Two pump sizes with capacities of 4 to 23.3 gpm and 9 to 34.1 gpm at 0 psi respectively—high-efficiency helical gears—anti-friction bearings.

The 500 Series for Pressures to 500 psi
Six pump sizes with capacities from 5.1 to 37.6 gpm at 0 psi—precision gears—long-lived needle bearings.



Here's the smooth, trouble-free way to pump large volumes of oil at high speeds. These eight Brown & Sharpe Pumps are rotary-geared for positive, reliable action . . . mechanically sealed for leak-proof operation. They've proved themselves in thousands of hydraulic installations. Find out what they can do for *yours*. Write for Catalog No. 35P describing the complete line of geared, vane, and centrifugal pumps. 135 standard items available from stock. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

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Brown & Sharpe

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Post Scripts of Industry

continued

William Grotenrath, Jr. A branch of the St. Louis district office has been established in Kansas City, supervised by **Curtis Beem. Eugene Raemdock** was named assistant district manager in St. Louis, and a similar position has been filled in the Philadelphia region of **Harold Moorehead.**

Vernon B. Benfer was appointed division general manager of the **Aircraft Engineering Division of Lear, Incorporated.** For the past three years he was staff assistant to the president.

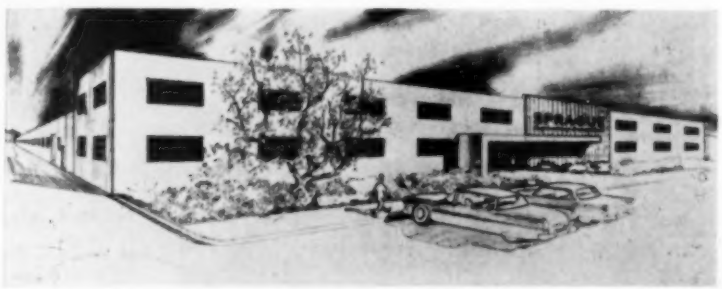
Glen J. Hartman has succeeded Raymond E. Dewey as manager of operations of **Ohio Seamless Tube Division of Copperweld Steel Company.** Hartman, who has been with the company since 1941, has served as assistant operations manager since May 1955.

Appointment of **Robert P. Marks** as field sales representative has been announced by **The Allen Manufacturing Company.** With company offices in San Francisco, Marks will cover the San Francisco and northwest area.

In expanding the sales coverage of their Eastern office, **Adel Precision Products,** Division of General Metals Corp., have added **David N. Harrison** to their staff. He was previously associated with Avro Aircraft Ltd. in Canada.

A. W. Cash Co., appointed **Erickson Industrial Products Co.,** Dallas, as north central Texas representative.

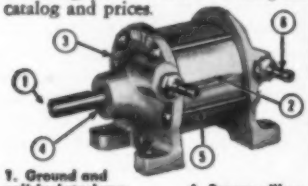
To centralize **Sprague Engineering Corporation's** operations which at the present time are carried on in five leased buildings at three locations, the company has started construction of a new building. To be located at So. Vermont Ave., Gardena, Calif., the building will cover 76,000 square feet.



AIR-MITE AIR CYLINDERS

Low Cost...Compact...Powerful...Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types

AIR-MITE Devices, Inc.

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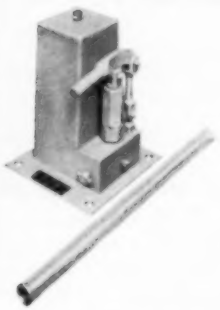
HAND

HYDRAULIC PUMPS

Single and Double Designs to 20,000 Psi
With or Without Reservoir



160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches
Catalog No. 160

We specialize in hand pump units to operate in temperatures from minus 65F to plus 160F and with any capacity reservoirs required.

The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE

Hydraulic Hand Pumps for 1001 Uses
1635 E. 22nd St., Los Angeles 11, Calif.

Circle 4 on Reader Service Card

Circle 101 on Reader Service Card

The Briggs Filtration Company has appointed **Stephen Johnson** as industrial sales representative for the Houston, Texas, area.

Stephen Johnson
The Briggs Filtration Co.

K. H. Knox jointed **Weston Hydraulics, Ltd.**, a Subsidiary of Borg-Warner Corporation, as engineering sales manager. He will assist the vice president in charge of sales in the direction of their technical sales program. Knox has had wide experience in the aircraft industry and until recently was associated with the Aircraft Hydraulic Division of Parker Aircraft Company.

Victor Emery has been named manager of the **Marine Sales Division of Aeroquip Corporation.** With the company since 1949, Emery has until recently been sales engineer in the New England area.

Victor Emery
Aeroquip Corp.

Gilbert Fox has been appointed by **Alco Products, Inc.**, to direct the sale of their fin-tube heat exchangers in the New York area.

James G. Osmond, president, **The Allen Manufacturing Company** named **Paul Pick** as chief engineer. Also announced was a complete reorganization of the engineering department. **Edward S. Loika** has become chief of production engineering; **E. Russell Carter, Jr.,** assumed charge of drafting, engineering order processing, product and tool standards, and departmental administration; **Alton W. Gross** becomes chief metallurgist and head of research and development; **Edward A. Pendleton** to coordinate all engineering projects; and **Michael Kubick** will supervise sales engineering activities.

Stillman Rubber Co. has acquired **Plasticast Inc.,** San Fernando, Calif. To be operated as the Plasticast Division of Stillman Rubber Co., it will specialize in polyvinyl dipping and coating, slush-molding, low-pressure injec-

Continued on next page

ready-made to your specifications

GAR HYDRAULIC RESTRICTORS

Whatever your restrictor requirements, chances are Gar already has units with the characteristics you're after. Gar hydraulic and pneumatic restrictors come in one-way and two-way types, and just about every other type, size and rating you can imagine. But, should you ever ask for special characteristics in pressure, flow, weight, temperature or envelope size that aren't standard at Gar, you'll never know, because we'll produce what you need in the same short delivery time, at the same low price.

Some extras that might interest you, too, for special applications are self-cleaning designs that work, and electroformed orifices that are unique for highest precision and absolutely identical flow characteristics.

But right now, the important thing is to call Gar. After that, you can leave the rest up to us.

RESTRICTORS ★ REDUCING VALVES ★ RELIEF VALVES ★ FILTERS ★ SNUBBERS

To cover a full range of temperatures, pressures, sizes

Send today for full information **GAR PRECISION PARTS, INC.**
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Circle 50 on Reader Service Card

Post Scripts of Industry
continued

tion molding of Plastisols, and open and closed cell foam vinyl. **Philip Keller** is general manager and **George Selby** is factory representative.

Vickers Incorporated have opened application engineering offices in Washington, D.C., to facilitate the expansion of their aircraft products sales activities. The new office will provide engineering design, development and service assistance to users of aircraft oil-hydraulic systems in the Washington and Middle Atlantic Coast areas. **Walter L. Flinn** moves from Detroit to head the new office and he will be assisted by **Jordan E. Johnson.** Johnson will also continue to service Philadelphia and Baltimore.

Walter J. Flinn
Vickers, Inc.

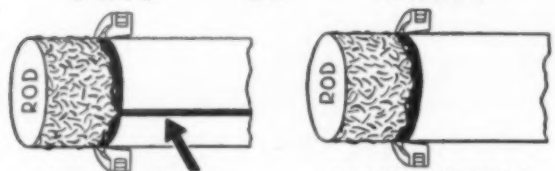
Jordan E. Johnson
Vickers, Inc.

Roy Van Ness was named manager of packing, special products and matting sales for **United States Rubber Co.** He started with U. S. Rubber as an assistant salesman in 1938, later transferred to development work at the Passaic plant and in 1947 was made assistant manager. Also announced were two new district sales managers. **Henry Davis, Jr.,** formerly sales manager in Baltimore, has been put in charge of the larger Pittsburgh district. **Douglas M. Smith,** with the Baltimore branch as a salesman since 1950, has become manager of the Baltimore sales area.

William O. Nussear, Jr. has become marketing manager of **Superior Tube Co.** He was previously the company's sales promotion manager.

Micro Metallic Corporation have promoted **Charles H. Hacker** to assistant sales manager. He has been a sales engineer with the company for four years.

This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For those dry operations requiring absolute freedom from dust or dirt passing through joint or ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint
(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use** the 3 Piece **FALL WIPER RING FWR-3C**

Spec Mil-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) an endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

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Fall Wiper Ring SPRING LOADED

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Chester C. Lonsdale has become assistant to the superintendent of the Pressed Steel Division of **Standard Pressed Steel Co.** Lonsdale, who will have charge of manufacturing and packaging for the division, joined SPS 15 years ago.

Chester C. Lonsdale
Standard Pressed Steel Co.

H. E. Schroeder has joined **Roylyn Inc.,** as production manager in charge of all production facilities. Prior to this appointment he was assistant to the president of Ohissen & Rice Inc.

Henry M. Wood of Cincinnati, has been elected to the board of directors of **Ross Operating Valves Co.** Wood has been a Ross Valve representative since 1940. He became a manufacturer's representative for industrial equipment in 1928 and his firm now services southern Ohio and Kentucky.

Dr. Robert K. Smith has been appointed manager of research for **E. F. Houghton & Co.** A graduate of Pennsylvania State College, Dr. Smith's special fields of interest have been concerned with the development of fortified lubricants for industrial equipment, specialty chemicals and studies of petroleum processes.

Aircraft Products Co., extending its sales coverage to the West Coast, have appointed **Western Aircraft Supply Co.,** Los Angeles, as its exclusive representative in this area. The company

Continued on next page

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Brand New! HYDRAULIC EQUIPMENT
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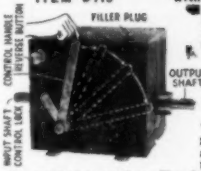
GROBAN HYDRAULIC SPEED REDUCER
ITEM #115 with FINGERTIP CONTROL



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Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of ¼ to 1½ H.P. Shafts ⅝" diam. Input rotation counter-clockwise facing shaft. Input speed 750 R.P.M. 7⅛" x 7½" x 11⅛". Gov't acquisition cost $428.00. Shpg. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago 54.50

GROBAN FOUR-WAY, OPEN CENTER
HYDRAULIC CONTROL VALVE

ITEM #126—Four way open center control valve, with built-in adjustable relief valve factory set at 1000 P.S.I. Spring loaded neutral position. For use with one double acting cylinder. In neutral position cylinder is locked and pump unloaded. Can be used as single unit or mounted in series. Has ⅜" pipe thread inlet and outlet. ½" pipe thread cylinder ports. Newly manufactured to our specifications. Ship. Wt. 8¼ lbs. An Outstanding Buy! F.O.B. Chicago 21.50

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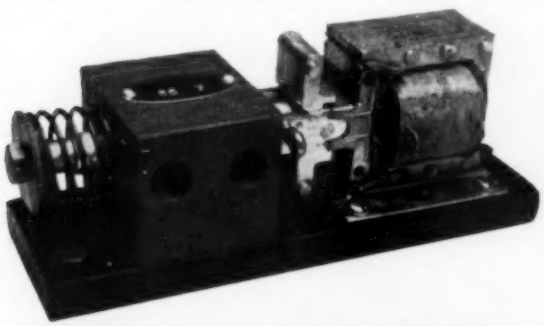

BACHMAN 4-way Solenoid Valve for 200 psi

¼" pipe ports with orifice equal to .312 diameter

Stock models include 2-way, 3-way and 4-way action with 110 or 220 volt single or double solenoids

Laminated phenolic construction

JOHN D. BACHMAN & CO.
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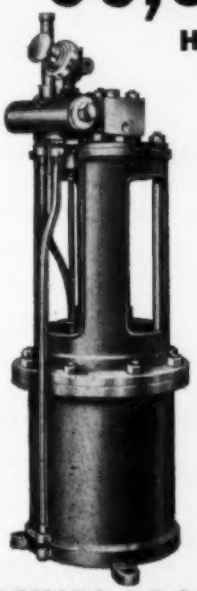
AIR-HYDRO-PUMP
60,000 PSI
HYDRAULIC PRESSURE
(with air-100 psi)



COMPLETE RANGE OF 35 STANDARD MODELS,
SINGLE OR DOUBLE ACTING

- Air-Hydro-Pump is the finest pressure unit for rapid testing of valves, boilers, piping pressure vessels.
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- Portable for site testing.
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- Made of non-ferrous metals and stainless steel.

Also 6 JUNIOR MODELS
Fluid pressures 400 psi to 10,000 psi $185.00 f.o.b. New York

DAVIES BROS. 120 WALL ST., N.Y. 5, N.Y.

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Post Scripts of Industry
continued

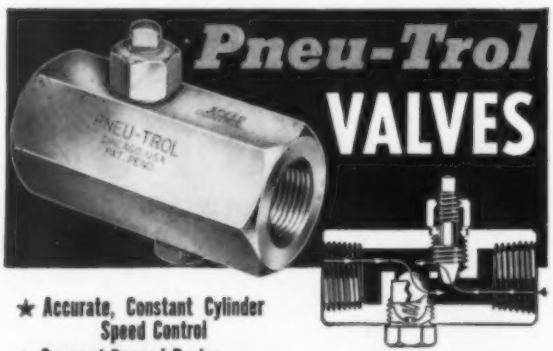
will handle the complete line of hydraulic and pneumatic aircraft components manufactured by Aircraft Products Co.

F. Parker Westerberg has been added to the sales engineering staff of **Greer Hydraulics, Inc.** He will serve the New England territory. Greer also announced the appointment of **Ernest W. Marchand** as director of manufacturing. Marchand has 30 years experience in manufacturing, much of it in the automotive field.

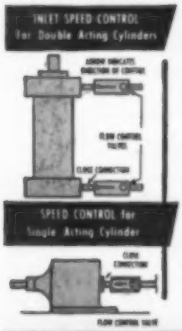
A branch office and warehouse has been opened by the **J. N. Fauver Company, Inc.,** at G-3140 E. Hemphill Street, Flint. The modern structure covers 3,000 square feet, and has a staff of four men headed by **John W. Mesterzsat.** This office was designed to give faster service to the Flint and Saginaw Valley industrial area.

Ernest W. Marchand
Greer Hydraulics, Inc.

The Koehring Company, Milwaukee, Wisconsin, has acquired through merger the **Hydraulic Press Manufacturing Co.,** Mount Gilead, Ohio. **Julien R. Steelman,** Koehring's president stressed that no changes in personnel or the operations of H-P-M were contemplated. H-P-M chairman of the board, **G. B. Robinson,** will fill the additional place being made on the Koehring board.



★ Accurate, Constant Cylinder Speed Control
★ Compact Rugged Design
★ Simple, Easy Speed Selection ★ For Air, Oil or Water Applications



Pneu-Trol Speed Control Valves, are widely used in hundreds of control applications because they combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to its seat, requiring only a slight differential pressure to fully open or close it.

Needle design permits maximum flow capacity in the controlled direction. Metal to metal needle and ball seats insure long trouble-free service. Simple, practical "O" gland structure eliminates troublesome leaking. Valve bodies machined from hex brass or aluminum for 2000 psi working pressures; steel and stainless steel for 5000 psi. Made in 5 female pipe sizes—⅛" to ¾". ATTRACTIVE PRICES . . . IMMEDIATE DELIVERY.

Write for illustrated circular and prices.

Pneu-Trol DEVICES, INC.
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THE *Right* GAUGE FOR YOUR SPECIFIC NEEDS

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• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

WRITE TODAY FOR COMPLETE INFORMATION

PRESSURE, VACUUM, COMPOUND, ALTITUDE, COMBINATION, DIAPHRAGM, HYDRAULIC, AND SPECIAL PURPOSE GAUGES, DIAL THERMOMETERS, (VAPOR TENSION OR BI-METAL)

MARSHALLTOWN MFG. CO.
800 East Nevada St., Marshalltown 4, Iowa

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Circle 86 on Reader Service Card

Automatic Switch Company have appointed **R. B. Dunning and Company,** Bangor, Maine as an authorized stocking distributor.

Ernest L. Richmond was promoted to chief engineer of **Worthington Corporation's** Plainfield, N. J. Division. He first joined Worthington's engineering department in 1945. In addition to calculation and design work, he will also assume responsibility for the engineering department's administrative functions.

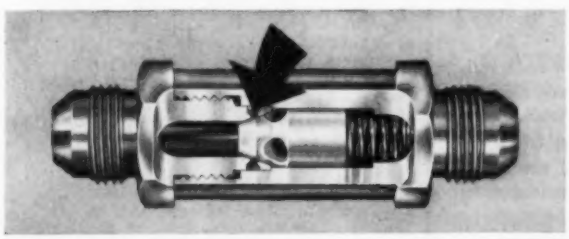
Ernest L. Richmond
Worthington Corporation

Wm. W. Nugent & Co., Inc. have moved their general offices and manufacturing facilities into a new plant located at 3440 Cleveland Street, Skokie, Illinois. Of single floor construction, the new building brings under one roof manufacturing operations which were previously divided in two locations.

Owen C. Davis was elected treasurer of **Vickers Incorporated.** He joined the company's Tulsa Winch Division in 1946 as controller and came to Detroit in 1950. Since 1954 he has been controller for the corporation. Also announced was the appointment of **Russell Dupuis** as the new plant manager of the Omaha Production Division. **Thomas B. Doe, Jr.** was named manager of export sales. He will be responsible for consolidation of all export sales activities involving aircraft, industrial and mobile equipment.

The newly created post of director of engineering for the Aeronautical Division of **Robertshaw-Fulton Controls Company** has been filled by **Vernon H. Vogel.** The post was created to unify several engineering functions and to implement a project approach linking the developmental and production activities of the division.

The **FLEXIBLE SEAL SEAT*** Simple, Secure, Long-Lasting!



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

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CHECK VALVES

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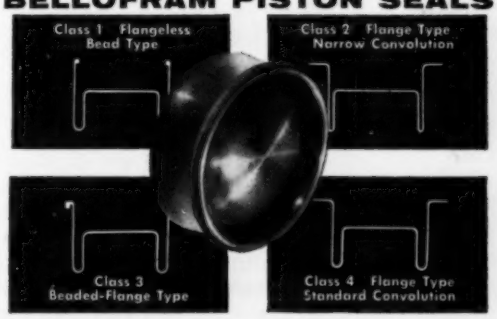
NOW THERE ARE 4 TYPES OF BELLOFRAM PISTON SEALS


Class 1 Flangeless Bead Type
Class 2 Flange Type Narrow Convolution
Class 3 Beaded-Flange Type
Class 4 Flange Type Standard Convolution

Bellofram long stroke, constant area diaphragms are now available in *four* designs, for efficient use as piston seals in countless types of pressure-sealed mechanisms. Class 1 permits design and manufacture of smaller, lighter, lower cost mechanisms. Class 2 is specially suited to high pressure applications and limited to sizes under 2½". Class 3 allows parting surfaces at flange joint to form a metal to metal joint. Class 4 is suitable for instruments and machines having natural parting surfaces between cylinder and mating metal surfaces.
Bellofram seals are available in any of 300 standard sizes; for 1" to 6" bores; in numerous elastomer-fabric combinations from Nitrile Rubber and Nylon to Silicone Rubber and Dacron. Choice is wide, design and operating advantages many. Outline your needs in confidence.

Have you a copy of the NEW 16-page Bellofram Catalog? Write today.

Bellofram
CORPORATION
BURLINGTON, MASS.

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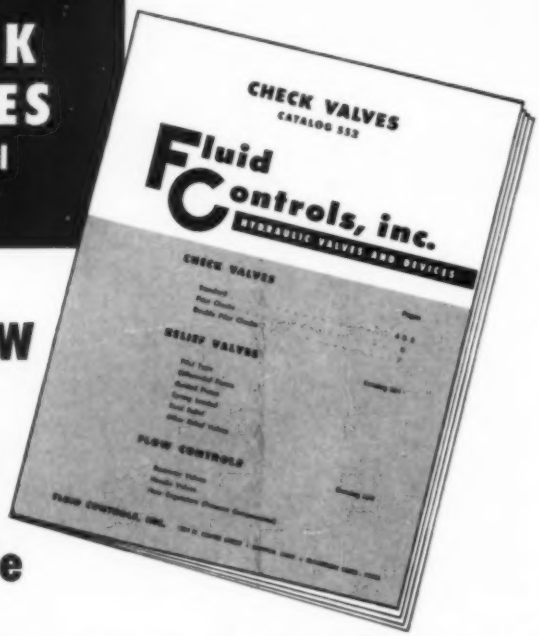
CHECK VALVES
For Oil



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Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
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Pressure Compensated Flow Regulators

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SEND your specifications for hydraulic cylinders to American, specialists in hollow boring and honing. We manufacture from tubing or forgings in carbon or alloy steels up to 15" I.D. Over 40 years experience backed by precision machines and skilled craftsmen will save you time and money. Send your blueprints.

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DISTRIBUTORS or REPRESENTATIVES

wanted for several open territories on our line of quality valves, cylinders, valve actuators and pumps. Write giving lines handled and territory covered. Ledeen Mfg. Co., 1600 So. San Pedro St., Los Angeles 15, California.

MECHANICAL ENGINEERS WANTED

Openings for three graduate engineers, familiar with shop procedures, at least 3 to 5 years of design or plant engineering experience involving machinery or materials handling equipment, with some knowledge of hydraulic or electrical control circuits, to design special hydraulically actuated machinery. Permanent position where you will be an individual with responsibility, not a cog in a huge organization. We are constantly expanding in the field of design and fabrication of custom built machinery, power transmissions and control systems for all industry. Located in an area of pleasant, relaxed living. Every kind of outdoor recreation available. Excellent family environment. Outstanding Universities nearby. Send resume and salary range desired to Mr. H. C. Zinta, Chief Engineer, The Rucker Company, 4700 San Pablo Avenue, Oakland 8, California.

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The Cardwell Machine Company, Richmond, Virginia, one of the major engineering and fabricating organizations in the South for hydraulic power units, hydraulic machinery, panels and consoles, requires young man for sales engineering job. Hydraulic background, not necessarily academic, sales correspondence experience, schematic circuit design are essential. Applicant will live in Richmond. This is a permanent position with good starting salary and excellent future in a company established for 129 years. Profit sharing, vacation, free life insurance and many other benefits. Write in confidence to E. M. Lipman, Vice President, The Cardwell Machine Company, P. O. Box 1359, Richmond, Virginia.

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Will buy all makes flares or compression, brass, steel or ermeto types; especially interested in Weatherhead and Imperial fittings.

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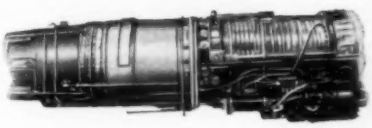
To Develop TEST FACILITIES for Jet Engine Fuel Control Systems and Components.

Working with: High Energy Fuels at Extremes of Temperatures and High Pressures



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Remote Instrumentation

Servo Operated Afterburner Fuel Controls, Inlet Temperature and Turbine Speed Sensing Electro-Hydraulic Servo Controls.

Applicant should have B.S. Degree Plus 4-6 Years Experience Relative to Hydraulic Engineering, Valve Design, Hydraulic Servos, Instrumentation and Testing of Fluid Control Devices, or Other Associated Fields.—Write to Mr. J. Heffinger, Supervisor of Salaried Personnel

AC THE ELECTRONICS DIVISION

GENERAL MOTORS CORPORATION

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These jobs offer more than engineering adventure. There's common-sense practicality involved, too. Electric Boat's backlog of orders and years-ahead plans; its record stable engineering employment; its sponsorship of advanced study at leading universities and within the plant are some of the practical features. New England living on the shores of Long Island Sound is another.

To find out more details about these opportunities, write us details of your background and experience including initial salary requirements. Interviews will be arranged promptly for qualified applicants. Please address **Peter Carpenter.**

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DIVISION OF GENERAL DYNAMICS CORPORATION

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Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

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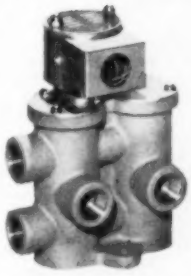
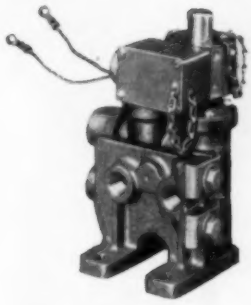
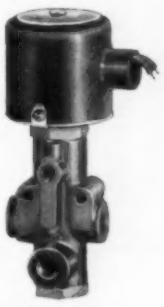
YOUR COIL BURNOUT TROUBLES ARE OVER when you switch to Crescent® Solenoid Valves



Standard 4-Way



J.I.C. Type 4-Way



Standard 3-Way

® 4-Way and 3-Way Solenoid operated, pilot controlled valves for Air, Water and light oil to 150 P.S.I., products of Crescent Valve Co.

NO COIL BURNOUT

because a generous power margin, short solenoid travel and pilot operation combine to prevent overheating and overloading. Note that these valves are accepted and used in automotive plants where assembly line production does not permit coil or valve failure.

LONG SERVICE LIFE

Main valve design is aimed at extremely long trouble free service. Resilient seats are tight sealing and are not affected or damaged by dirt or grit because they are of a self scavenging design. Witness their superior performance in such severe service as operating hopper doors on cement batching equipment and in other dusty environment.

INTERCHANGEABILITY

Solenoids and pilot sections are interchangeable from one valve size to another, minimizing spare parts requirements. Adaptation to any practical voltage is achieved by a simple coil change.

Speed of response, speed of installation and dependable leakproof operation year in and year out are responsible for the increasing switch to Crescent valves on production machinery where time is money.

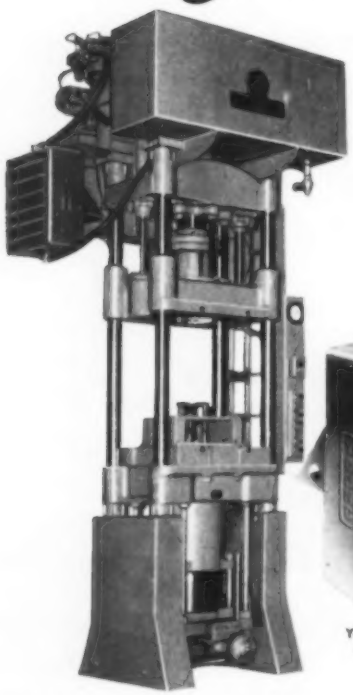
For complete data write for Catalog 6-C.

BARKSDALE VALVES

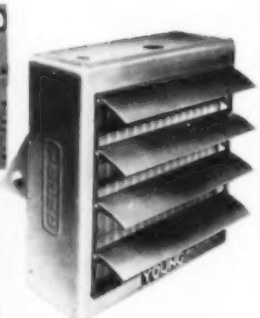
5125 Alcoa Avenue, Los Angeles 58, California

200-ton platen presses depend on

Young Cooling



Rodgers 200-ton "Fast Acting" metal working platen press equipped with Young "OH" Type Unit Oil Cooler.



Young "OH" Type Unit Oil Cooler.

Young Unit Oil Coolers cool hydraulic oil for metal forming and drawing presses

Rodgers Hydraulic, Inc., specifies Young "OH" Unit Oil Coolers for its 200-ton platen presses. The Young units cool the hydraulic oil and transform the waste heat into useable heat for space heating. Patented Turbulators break up hydraulic fluid flow, creating a wiping action which increases heat transfer efficiency 100%.

The metal working industry is only one of the many industries employing Young cooling equipment. Specify Young for your next heat transfer application.

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Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.

Young RADIATOR COMPANY

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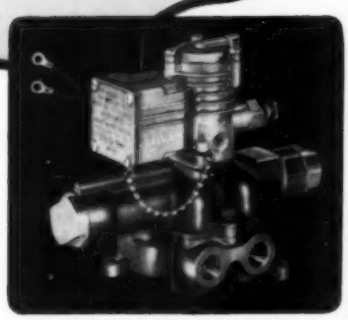

Single Solenoid Speed King built to JIC standards. Guaranteed against coil burnout for life of valve.

Perhaps you're puzzled over which make of valve to buy. Or confused by a welter of unsupported *claims*. Some valves feature this advantage, some feature that.

But put them all together. Sift fact from fallacy. Match actual performance *records*. Compare *quality*, *workmanship*, *guarantee*—and you'll arrive at one inescapable answer. It's —*Valves by Valvair*.

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Circle 137 on Reader Service Card

His calling card had claws on it

LUTHER KELLY lied about his age and got into the army at 15. They sent him West in 1865, and he stayed.

He liked the wilderness. Game abounded. In Trappers' Lake, "trout were so thick they obscured the bottom."

Hostile Indians were also pretty thick. But when two tried ambushing him, he killed both with his Henry .44.

He learned Sioux and sign language.

One day, he visited General Miles, sending a huge fierce-clawed bear's paw to Miles as his calling card. Miles made him chief scout against the Sioux.

But by 1885, the country was taming down, and Yellowstone Kelly left it.

Two decades later, Teddy Roosevelt praised the heroic treasurer of Surigao in the Philippines who saved the town from outlaws. Name: Luther S. Kelly.

Yellowstone Kelly's body now rests at Kelly Mountain in Montana. But his restless, pioneering spirit lives on in the heart of today's America. For it is the trail-blazing courage of 165 million people that makes America great, and that provides the real strength behind one of the world's finest investments: our country's Savings Bonds.

Why not guard your security with this strength? Invest in U.S. Series E Savings Bonds. And hold on to them!

It's actually easy to save money—when you buy Series E Savings Bonds through the automatic Payroll Savings Plan where you work! You just sign an application at your pay office; after that your saving is done *for* you. The Bonds you receive will pay you interest at the rate of 3% per year, compounded semiannually, when held to maturity. And *after* maturity they go on earning 10 years *more*. Join the Plan today. Or invest in Savings Bonds regularly where you bank.

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